THE MARINE REVIEW

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ELECTRIC DOCK AT SUPERIOR.

Considerable interest has attached to the handling of coal at the Duluth-Superior harbor, which has come to be the principal receiving port for upbound coal on the lakes, and not without reason, for the coal handling installations there are worthy of that attention as shown by the number of excellent records made during the season of 1906. Particularly is interest centered in the operation of the comparatively new electric docks, types of which are the new Hanna dock and the No. 1 dock of the Northwestern Fuel Co. The latter particularly has been much commented upon and occasion is taken to present some of the facts and features about its design, equipment and construction, the entire completion of which only came during the latter part of last season.

A general view of the dock from the water side as one might see it from a boat moving up Superior bay to unload is shown in Fig. 1, where the size of the newly-built anthracite coal storage sheds is plainly indicated. The storage dock, used exclusively for bituminous coal, is built out into the lake and rests on timber cribs 18 ft. wide by 28 ft. deep filled with sand that was pumped in by hydraulic dredge. This foundation is covered with maple plank giving a storage area 1,300 ft. long by 600 ft. wide. The railroad facilities for handling the coal off the dock constitute about two miles of railway, connecting the plant with all of the lines entering Superior. There is a double trackage both on the slip side of the dock, for cars where direct loading from the boat through the shipping bins is desired and also a double trackage at the rear end for loading from the stockpiles. Two continuous storage and shipping bins, each 1,000 ft. long, 128 ft. high and 456 ft. apart are located, as shown in Fig. 2 just inside the railroad tracks at the front of the dock.

The unloading equipment consists of four Brown-Hoist steel electric fast plants, shown in Fig. 3. These unloading towers spanning the railroad tracks above mentioned, are 103 ft. in height and carry clam-shell buckets with capacities of 1½ tons of bituminous coal or two tons of anthracite. The coal may be dumped by the clam shells either into the bins adjacent when intended for direct loading into railroad cars, or, if intended for storage may be carried to one of the three steel bridges, 508 feet long, covering the dock and by means of which the coal is carried from the front of the dock to the proper storage place. To accomplish this three double bucketed transfer cars are installed to operate under the hoppers of the unloading towers and over the

FIG. 1.—VIEW OF NORTHWESTERN FUEL CO. DOCK NO. 1 FROM THE BAY.

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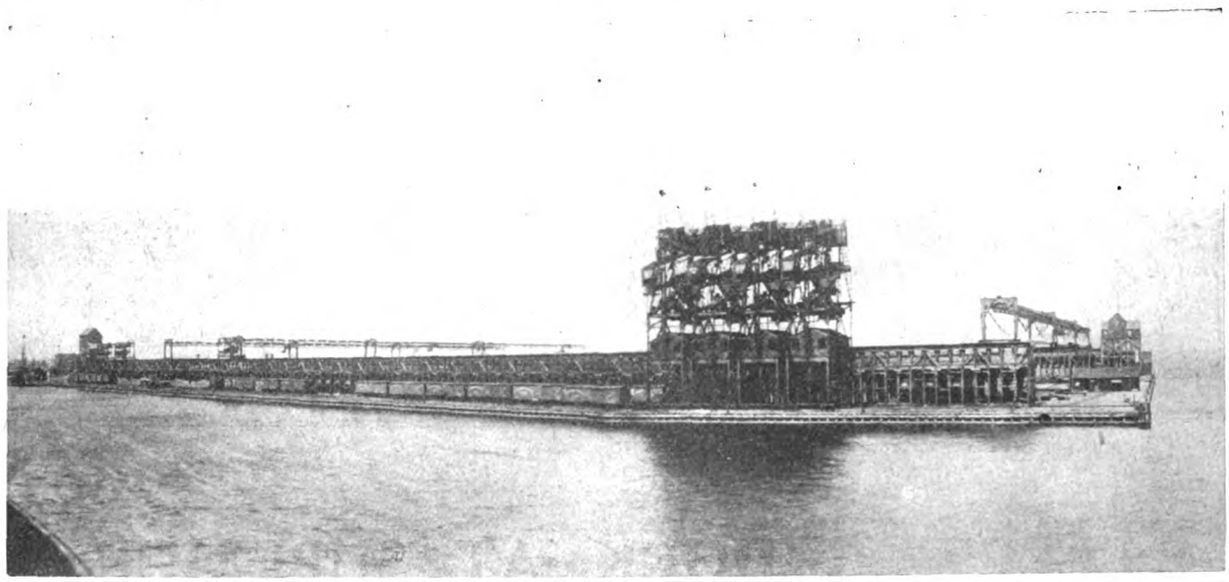

FIG. 2.—VIEW OF DOCK SHOWING BINS, BRIDGES AND UNLOADING TOWERS.

entire length of the bins also delivering the coal by the transferring of the buckets to each of the bridges. The hoppers in the unloading towers into which the clam shell dumps itself have a capacity of 12 tons and the transfer buckets about 7 tons. In discharging the coal the buckets of the transfer cars are lowered down to avoid dropping the coal on to the dock from any height, thus reducing breakage to a minimum. The rear end of the bridge is also equipped with 4-ton grabs for reloading from the stock-pile into cars. The complete operation is electrically controlled by a single operator in each tower.

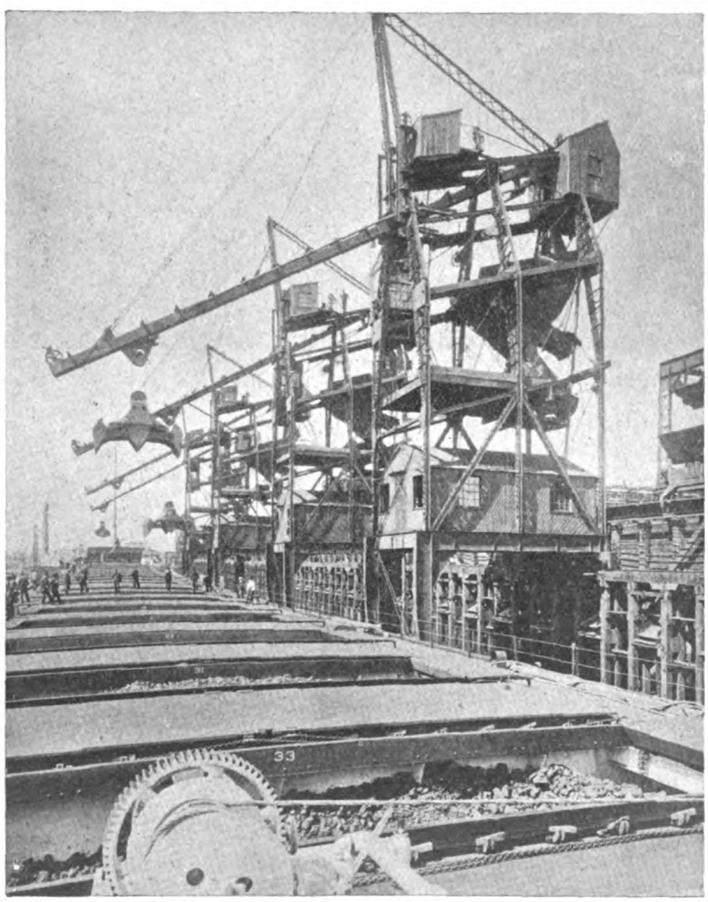

FIG. 3.—BROWN HOIST UNLOADING TOWERS.

The dock is equipped with adequate screening capacity for such separations of coal as are desired and also with two Ottumwa electric box loaders operating along the face of the bins on a separate track. These loaders have their own traction power providing considerable flexibility in loading. The electric power plant is enclosed in a brick building and consists of four similar units made up of 200-kilowatt General Electric generators direct-connected to 200-horsepower Buckeye automatic simplex engines. This plant is supplemented by a storage battery of 120 cells rated at 1,360 amperes per hour to be used as an equalizer as in a traction or lighting plant. Steam is supplied by six 150-horsepower horizontal return tubular boilers using induced draught. The handling capacity of the dock is approximately 800,000 tons a year and an average capacity in unloading is 125 tons per hour per hoist. Much better has been done than this, however, under favorable circumstances, as for instance, the unloading of the steamer Henry S. Sill on Aug. 20, 1906, which record was as follows:

Started to unload at 7 a. m., Aug. 20, with two rigs. In the first ten hours 4,049 tons were unloaded, an average of 202.45 tons per hour per rig. Work was stopped at 6 p. m., and resumed again at 7 a. m. on the 21st. The entire cargo, consisting of 7,262 tons, was unloaded at 5 p. m., making the unloading time 19 hours, taking out an hour at noon each day. The average rate of unloading, therefore, for the entire cargo was 191.1 tons per rig per hour.

The separate section of the dock just

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completed is devoted to the handling and storage of anthracite coal and is 700 feet long by 600 feet wide. The two storage buildings mentioned above are each 576 feet long by 144 feet wide and 72 feet high with a storage capacity of 100,000 tons each. Coal is unloaded here as on the bituminous dock by two Brown Hoist electric unloading towers which are mounted on trucks and rails, so that they may move the length of the building and unload a boat without its being shifted from its original berth. Parallel to the slip is a conveyor onto which the clam shells dump their coal, the conveyor being designed to run in either direction carrying the coal to similar conveyors running at right angles along the ridge of each building. From the last named conveyors, onto which the coal is discharged and which are equipped with adjustable ribbon bottoms, the coal may always be discharged into the sheds upon the apex of the pile by the adjustment of the conveyors as the quantity of coal increases and builds up from the floor, thus decreasing the breakage due to the fall.

Coal not intended for storage can be delivered from the boat direct to shipping pockets where it is graded and prepared direct for shipment without stocking. Coal to be shipped from the storage sheds is loaded on conveyors running in tunnels beneath, between the foundation piling of the building to a conveyor running at right angles at the rear of the buildings, which latter conveyor delivers coal to large shipping pockets of a capacity of 3,000 tons. At the shipping pockets the coal is screened and then loaded into the cars by a Smith gravity box car loader, which is unique in the west, at least, among car loading coal machinery. This loader permits of the car being moved on to a cradle which is capable of being tilted to an angle of approximately 30 degrees on either side of the center. The coal going in to the car on a conveyor at a rapid rate, about 300 tons an hour, forms first, with the car in a level position, a wedge-shaped pile in the center. The car is then tipped with one end up and is filled in the same manner at the low end. With its position reversed and the opposite end low, that is filled, so at the completion of the three operations the car is filled uniformly with a solid body of coal evenly distributed. This tilting operation proceeds without interruption in the loading of the coal. The car is then released from the cradle and weighed and is ready for shipment.

By means of this elaborate and complete installation for handling the coal, both bituminous and anthracite, and the uniform system of electrical operation throughout, the Northwestern Fuel Co. is able to take full advantage of the dockage space at its disposal and as many as three boats may be unloaded at one time. The water length of its dock is 1,800 feet and the slips are dredged to a depth of 21 feet. The docks have a total storage capacity of 500,000 tons, which precludes any possibility of congestion during seasons of such rapid movement of coal as was witnessed in 1906 and will in all probability be true during the coming season. The layout of the dock has been under the direction of B. A. Gallaher, general superintendent, and is a worthy achievement in the handling of lake coal.

METROPOLITAN OUTSIDE LINE.

Official announcement was made that the new Metropolitan Outside line, otherwise known as the all-water route between New York and Boston, will commence to dispatch its new steamers Yale and Harvard, now under construction, about June 1 next. The reports of the ship builders justified the report that the vessels will be completed in time. These steamers will have more rooms equipped with private baths and toilet accessories than are to be found on any other steamships of their size in the country. They are scheduled to leave New York daily, Sundays included, from Pier 45, North river, foot of West Tenth street, at 5 p. m., and to leave India wharf, Boston, at the same time, due to arrive at either end of the route at 8 o'clock the next morning. The Sunday trips will only be continued during the summer months.

The route followed by the Metropolitan outside line is sometimes supposed to be by way of Sandy Hook, Nantucket lightship, etc.; perhaps the word outside has given that impression. This, however, is wrong. The route follows the same course as is followed by the Long Island sound steamers, and then continues out on the Atlantic ocean, thence through Vineyard sound near the southern extremity of Cape Cod, then through Nantucket sound, and again out on the Atlantic ocean around Cape Cod, and on to Boston.

Passengers traveling by the Metropolitan outside line steamers will be able to leave New York or Boston in the afternoon and arrive in either city the next morning without the necessity of arising early in the morning to make train connections.

The Yale and Harvard are of steel double hull construction, their hulls being divided into many compartments by watertight bulkheads and double bottoms, thus establishing a great factor of safety. It is intended that the quarterdeck, or social hall, which passengers enter upon boarding the steamer, shall be most comfortable and rich in its furnishings. Upon this deck will be located the purser's office, package rooms, news stand, barber shop, etc., while from this deck also the dining hall will be entered. The dining room will be spacious, and, being open to outside view, will insure the maximum of cheerfulness and ventilation. The forward part of this same main deck, as well as its midship sections, will be fitted to accommodate freight and for machinery inclosures.

The aim of the management will be to have the dining room service, with its accessories, in keeping with what travelers in these days expect and even demand, while every feature of the ships, which have most delightful waters and attractive geographical situations as a route, will appeal to those who appreciate the comforts, conveniences and service which are looked for in the most modern hotels of this age.

The general dimensions of the ships are as follows: Length over all, 407 ft.; breadth over guards, 63 ft.; space between inner and outer bottoms, 3 ft.; draught of water, loaded, 16 ft.; accommodations for passengers, 800; express freight capacity, 600 tons; motive power (triple-screw Parsons steam turbines), 10,000 H. P.

H. T. & L. T. Carlisle, dealers in dry goods, carpets and linoleums, of Ashtabula Harbor, have arranged to have G. S. Eddy look after the wants of the vessel trade. Mr. Eddy has an extensive marine acquaintance and L. T. Carlisle says his firm proposes to devote every effort to keeping special marine stocks.

James E. Scoville, of Ashtabula Harbor, has one thousand pocket dictionaries and the same number of calendars which captains, mates, engineers and other marine men are cordially invited to call for when they strike Ashtabula. Mr. Scoville is sole agent for the Emerson shoe.

E. H. Burrill, of Ashtabula Harbor, will start the season of 1907 with a new 32-ft. launch built by J. G. Laird & Son. The new craft has a main deck and scuppers for carrying ice and meats.

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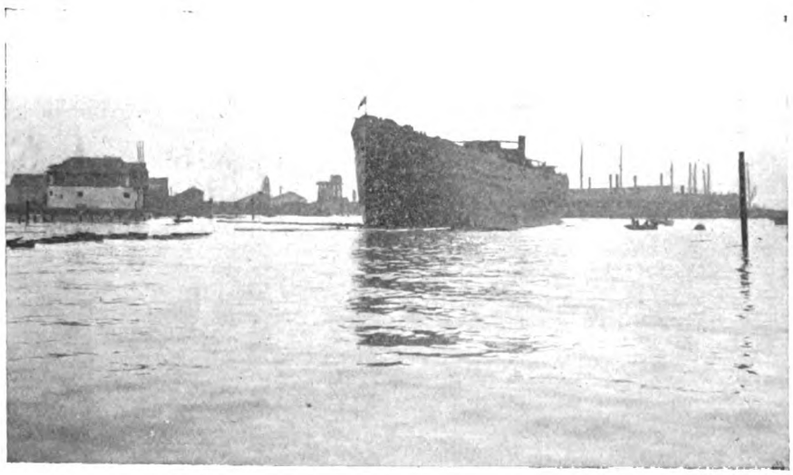
AMERICAN - HAWAIIAN CO.'S STEAMERS.

The American-Hawaiian Steamship Co. is now having built at the yard of the Union Iron Works, San Francisco, Cal., three large steamers that are to be placed in this new and important service. One of the large freighters was very recently launched and is now rapidly approaching completion. This vessel is the Mexican and she is expected to go into actual commission within two months. The Mexican is the largest merchant vessel ever built on the Pacific coast. She is larger than the freighter Arizonian (owned by the same company) that was built a few years ago at the Union Iron Works.



LAUNCH OF THE MEXICAN.

The Mexican's keel was laid Oct. 31, 1905, and work has been crowded forward ever since. The total length of the steamer over all is 490 ft.; beam, 57 ft.; hold, 43 ft. The other two vessels now in course of construction are the Columbian and Isthmian. The Columbian will be ready for launching early in the spring, and by midsummer will be in commission, while her big sister, the Isthmian, will be launched before the close of 1907.

The Mexican with the Columbian and Isthmian are being constructed for the new service that is to be very soon inaugurated by the American-Hawaiian Steamship Co. The former route of this company's steamers—the Arizonian and Texan—between New York and San Francisco has been by way of the straits of Magellan, but since the completion of the railroad by the Mexican government, across the isthmus of Tehuantepec, a distance of 184 miles, the steamship company has entered into a contract with the railroad company. This contract dates from Jan. 1, 1907, and will continue in force until the completion of the Panama canal, whereby the freight of this line will be carried by that route.

The steamers will ply from San Francisco and Puget sound ports to the Hawaiian islands, then to Salina Cruz, (Tehuantepec)—the terminus of the railroad on the Pacific side of lower Mexico.

At Salina Cruz, the freight will be transferred to cars, and a short run will land it on board the company's steamers at Coatzacoalcos, the eastern terminus on the gulf of Mexico. This new route of the line will be nearly 9,000 miles less than via the Horn, and 1,200 miles shorter than by the Panama route. It is expected that freight bound either east or west between San Francisco and New York will be carried in almost as quick time as the trans-continental railroad lines do at present.

An immense volume of traffic that is now done by the Panama route will undoubtedly be transferred to the American-Hawaiian Steamship Co. The Mexican will be placed on the Pacific side of the new route just as soon as she is ready for service, and will be followed in succession by the Columbian and Isthmian. The steamers Arizonian and Texan will be placed on the eastern end of the route—plying between New York and Coatzacoalcos.

To some extent the establishment of this new route means a revolution in the transit of freight by ocean between the east and the west. It is one of the most important moves made in many years, and the advantages to the commerce of the Pacific coast and that of the Atlantic seaboard, can scarcely be overestimated.

THE SCREW PROPELLER.

At a meeting of the Institute of Marine Engineers, London, held recently, Mr. W. Preidel read a paper entitled "Some Propositions and Proposals Regarding Screw Propulsion." Mr. Alexander Boyle (chief engineer examiner to the board of trade) was one of many expert engineers present who are interested in this important subject.

Mr. Preidel, in the course of his paper, said that when the screw was first introduced as a medium for propelling vessels the advocates of the same used to compare it to a bolt, the water supplying the nut. The phenomenon of "slip," however, was too soon evident, and the opponents of the screw denounced it on account of its "slip." Many people worked hard to reduce it to zero, nearly all of them agreeing that so much "slip" was so much power lost. Afterwards propellers were made which worked with little or, in fact, apparently with no "slip," and according to the proposition that "slip was loss," those propellers ought to have been the most efficient. Yet ship owners had propellers like those removed and replaced by others which worked with some positive "slip," and thereby they generally obtained better results. The bolt and nut theory was consequently given up in so far as the screw should advance its full pitch, and "slip" was accepted, so to speak, as a necessary evil.

In 1865, Professor Rankine announced that all propelling instruments which acted on the water obtained their forward thrust by forcing a certain amount of water in the opposite direction. That proposition, which showed that "slip" of the screw was necessary in order to obtain thrust, was almost generally accepted and was still the fundamental principle of propeller theory. He thought the fact that a screw propeller merely rotated round its axis (consequently its line of action was at right angles to a straight line astern) had been greatly overlooked, and he did not think anybody would claim that the line of action of a reciprocating piston was the same as that of the fly-wheel. When the propeller rotated it pressed on, and eventually displaced, the water between the blades to the axial or horizontal length and respective diameters, so that the quantity of water acted on was represented by open disc area multiplied by mean horizontal length of blades, divided into two, three, or four portions according to number of blades. The principal causes and effects with ref-

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erence to screw propulsion were as follows: Prime cause: Gravity and flexibility of water. Effect of prime cause: Water surrounding propeller at all points. Second cause: Rotating energy contained in propeller. Effect of second cause: Displacement of water. Aften that the prime cause would again come into operation, and so on. The results of a propeller—that was speed of vessel for rotating energy—would depend on (a) How it displaced water, which was the second effect; and (b) How it could be surrounded again, which was the first effect. Both those factors were of equal importance, and whilst a great deal of attention had been paid to the displacement of water, it had generally been taken for granted that the screw could easily be fed if it was not put behind a very blunt stern.

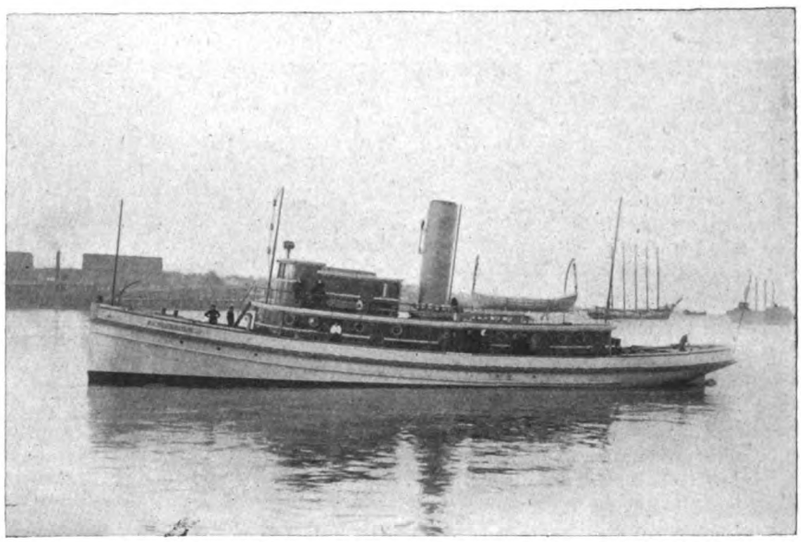
Coming to the practical side of the question, he might say he knew that a great number of proposals had been made and tried which should counteract lateral slip. Roughly, they can be divided into about foun classes: Firstly, there were those which made the blades hollow from the boss towards the periphery. Secondly, there were a great number of proposals or patents to bend over the tips of blades to prevent the water from slipping off. Thirdly, there were a number with corrugated blades or cross pieces fixed on the driving faces, and fourthly, there were proposals for propellers working in cylinders or having rings fitted all around them. He did not intend to say anything about any of the proposals. He proposed the use of a propeller with a recessed circular ring. The recesses were to be in front from the leading edge of blade to somewhere near the trailing edge of the preceding blade, and the ring to continue a little way complete behind the blades, as shown by the model they had before them.

The shape of blades used would not be the general oval shape, but would be either of uniform width in the axial plane or widest on the periphery. The retained portions of the ring over the driving faces were there to prevent the water going away in any other direction but directly astern. The recesses were there that the screw might be fed from the sides towards the center and thereby reduce rotation of the water within the propeller. The propeller could, therefore, be made of more than usual horizontal length. The projecting portion of the ring was to equalize the pulsation of the water caused by the blades and thereby reduce any vibration. That construction further enabled the use of certain combinations of angles or pitch ratios almost independent of engine revolutions and placed the most effective portion of blade at the greatest diameter of screw, where ample feed-water could be obtained from the sides. That side-feed enabled propellers to be worked with higher slip ratios without augmenting the hull resistance, and it seemed almost impossible that a complete rupture could occur as happened now with fast revolving propellers.

Those propellers could be made smaller by from 10 per cent to almost 30 per cent of present diameters, which should compensate the skin friction of the ring, whilst increased length, better thrust angle, and higher rate of acceleration made for more efficiency. The ring gave the propeller greater strength and, therefore, longer life, which should compensate for a little more weight. As the whole disc of the propeller was open at the back, those propellers would also answer quite well going astern, if not rotated quite as quickly as when going ahead.

Mr. Preidel then read a report showing the results obtained by the propeller he had described when working on a steam launch 43 ft. long on the water line. With the ordinary type of propeller they obtained a speed of 7½ knots at 372 revolutions, developing about 13½ I. H. P. A few weeks later a test was made with the new propeller, when a speed of 7¾ knots at 359 revolutions, with 11½ I. H. P., was obtained. His own conclusions, based upon the tests he had carried out, were that in cases where the diameter of the propeller was limited by circumstances, and where, consequently, wide-tipped blades were used, and, also, where absence of "wash" and vibration were of importance, the new propeller which he had described could be recommended.

A lengthy discussion ensued, the members mostly asking questions by a direct reference to the model propeller on the platform, or by diagrams and mathematical comparisons shown on the blackboard. The qualities of the new propeller were discussed and criticised, and that the idea was deemed well worthy of more mature consideration was evidenced by the fact that certain of the speakers expressed a desire to withhold any direct expression of opinion until they had had time to read through and thoroughly digest the theories advanced by Mr. Preidel.



TOWBOAT PEJEPSCOT.

TOWBOAT PEJEPSCOT.

The Portland Co., Portland, Me., has just delivered the towboat Pejepscot to the Bay Shore Lumber Co. This company is a subsidiary of the Bowdoin Paper Co., Pejepscot Mills and Lisbon Falls Fibre Co., all owned by F. C. Whitehouse, of Brunswick, Me., and David C. Cowles, of New York, and their associates. Mr. Cowles is at present the president of the American Pulp & Paper Association. These mills recently purchased a large tract of land in New Brunswick and organized the Bay Shore Lumber Co. They are having a number of large barges built and recently placed the order for the towboat with this company.

She is one of the finest boats on the coast and is fitted up more as a yacht

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than as an ordinary towing machine. She is 109 ft. long, 23 ft. beam and 10 ft. 9 in. deep. Has a Scotch boiler 12 ft. diameter and 12 ft. long with three furnaces and a working steam pressure of 165 lbs. The engine is compound 15-32 x 22 in. and has a normal horsepower of 450 and in emergencies can be worked up to about 600.

The Pejepscot was delivered to the owners Saturday afternoon, a large party coming up from Brunswick, Me., to take the sail from Portland to Bath, which is to be her hailing place. Her principal business will be towing the pulp wood from New Brunswick, Can., to Bath, where the wood will be reshipped in cars and sent to the various paper mills belonging to this company.

The house is finished in natural wood. In the after part of main house are four finely appointed state rooms to be used as guest rooms. On the upper deck aft the captain's cabin is a private dining and lounging saloon for the use of guests.

The galley is finely fitted and is very large for this size boat. The boat is lighted in every part by electricity and is supplied with a 14-in. Rushmore searchlight. She has a complete outfit of independent auxiliaries and no expense has been spared to make her one of the finest boats on the coast. She is painted a light cream color with government buff trimmings. Her stack is buff with two broad dark bands at the top as a private signal. The speed developed by this boat on her trial trip under normal conditions, was about 14 miles per hour. She is to leave Bath today with her first tow which will be a large car float for one of the railroads in New York, which has just been built by the Kelly & Spear Co., of Bath.

The entire outfit of machinery in this boat is almost an exact duplicate of that furnished in the towboat Orion which the Portland Co. recently built for the Boston Towboat Co. of Boston, and also the same as the City of Stamford which the Portland Co. is building for the North & East River Navigation Co. of New York.

The freight steamer Ocmulgee, built by the Fore River Ship Building Co., Quincy, Mass., for the Brunswick Steamship Co., left the works of the contractors on Thursday, April 4, for delivery at New York. This is the fourth steamer delivered by the Fore River Ship Building Co. for coastwise trade between New York and Brunswick, Ga. There is one more steamer to be built and delivered of the same type. The captain of the Ocmulgee is C. W. Mason.

APPOINTMENTS OF MASTERS AND ENGINEERS.

		CAPTAIN.	ENGINEER.
		MILINOKETT STEAMSHIP CO., BAY CITY, MICH.	
Str.	Milinokett	A. J. Mahon	E. A. Hoffman
		CHARLEVOIX LUMBER CO., CHARLEVOIX, MICH.	
Str.	Pine Lake	J. E. Jacobson	William L. Martin
		SHOAL WATER TRANSPORTATION CO., MT. CLEMENS, MICH.	
Str.	Norwalk	Frank Goodrow	
		SPENCE BROS., CLEVELAND, O.	
Str.	Aztec	E. F. Mattison	Fred Welsh
"	H. E. Runnels	F. W. Manuel	John Bloom
Bge.	Miztec	A. H. Larsen	
		ST. LAWRENCE & CHICAGO STEAM NAVIGATION CO., TORONTO, CAN.	
Str.	W. D. Matthews	James Ewart	E. J. O'Dell
"	Iroquois	W. H. Wright	William Harwood
"	Algonquin	John Williams	Charles Robertson
"	Rosedale	P. J. Shaw	Wallace Robertson
		STEWART TRANSPORTATION CO., DETROIT, MICH.	
Str.	A. E. Stewart	Fred Stewart	Robert R. Lacey
		S. W. TRANSPORTATION CO., CLEVELAND, O.	
Str.	A. G. Lindsay	C. H. Woodford	John Duchene
		TONAWANDA IRON & STEEL CO., N. TONAWANDA, N. Y.	
Str.	Clyde	R. H. Pardy	H. D. Fifield
"	John F. Eddy	G. H. Lane	E. H. Parry
"	Fleetwood	A. Johnson	G. DePuy
"	Mercur	J. T. Kenny	J. E. Westrick
"	Harry Packer	Charles Christy	Fred Hebard
"	Veronica	P. Keischgens	Abe Woods
"	C. F. Curtis	F. Conlin	John Johnson
Sch.	T. S. Fassett	A. Mills	
"	N. C. Holland	J. H. Christie	
"	Remington	S. L. VanDusen	
"	Moravia	F. A. Gould	
Str.	Oceanica	C. C. Hanley	J. I. Kinsey
		TONAWANDA TRANSIT CO., N. TONAWANDA, N. Y.	
Str.	Charles Weston	J. A. Fleck	R. Shinsky
		UNION STEAMBOAT LINE, BUFFALO, N. Y.	
Str.	Starrucca	John C. Clarke	A. A. Brown
"	Ramapo	J. A. McDonald	H. Johnson
"	Owego	George W. Moore	E. T. Jenkins
"	Chemung	F. R. Gebhard	Nelson Johnson
"	Tioga	C. W. Watson	W. A. Hayes
"	Binghamton	Thomas Stevenson	John Caul
"	Chili	W. T. Sutherland	E. T. Everill
		VULCAN STEAMSHIP CO., CLEVELAND, O.	
Str.	William B. Davock	Benson Fox	Robert C. Cummings
		NORTHWESTERN TRANS. CO., DETROIT, MICH.	
Str.	Harvey H. Brown	D. Girardin Sr.	Nicklas Anderson
"	Fayette Brown	D. Girardin Jr.	Joseph Bouffard
"	S. R. Kirby	Thomas H. Sanders	Martin Layman
Bge.	George E. Hartnell	Walter Girardin	
		ROBY TRANS. CO., DETROIT, MICH.	
Str.	L. C. Waldo	John Duddleson	N. E. Allen
		WALLACE & CUNNINGHAM TRANSIT CO., DEARBORN, MICH.	
Str.	W. B. Morley	Arthur Sturgis	Herman Gunderson
		JOHN J. WARDE, CHICAGO, ILL.	
Str.	Niko	Thomas Beggs	Clarence J. Dickey
Bge.	Annie M. Peterson	Thomas Higgins	
		W. A. HAWGOOD & CO., CLEVELAND, O.	
Str.	Salt Lake City	James Owen	John Chapman
"	Sheldon Parks	J. W. Montgomery	George H. Charlton
"	Henry B. Smith	C. C. Balfour	Thomas Braund
"	Abraham Stearn	L. A. Rand	Alex B. Wilson
"	Edwin F. Holmes	Joseph E. Mahon	Charles E. Timleck
"	Bramsford	Melvin Budd	John Norton
"	J. M. Jenks	William D. Ames	George Robins
"	Harold B. Nye	Ralph Nutting	G. H. Miller
		HENRY McMORAN, PORT HURON, MICH.	
Str.	Gogebic	Alvin C. Neal	George Merrill
"	Pawnee	Peter Eckbert	Edward Mehner
"	Britannic	E. H. Davis	Frank Cadotte
		PORT HURON & SARNIA FERRY CO., PORT HURON, MICH.	
Str.	O. D. Conger	William S. Major	William Waugh
"	Hiawatha	Ed M. Thomas	John Lee
"	Grace Dormer	George Waugh	John Kinirie
		R. O. & A. B. McKAY, HAMILTON, ONT.	
Str.	Strathcona	J. Irving	Eng. King
"	Donnaconna	J. W. Mawdeslay	Robert Mackay
"	Wahcondah	Capt. Hollingshead	
"	Neepawah	Oliver Patenaude	Andrew Leitch
"	Dundee	Harry Zealand	Eng. Andrew
"	Glenallah	Capt. Mackey	R. Duguid
"	Winona		John Duguid
"	Dundurn	Capt. Cooney	Eng. Cotre

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APPOINTMENTS OF MASTERS AND ENGINEERS.

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" Hennepin	Stephen Brownell	Frank P. Snyder
JAMES CORRIGAN, CLEVELAND, O.		
Str. Australia	R. E. Donaldson	John Radford
" Caledonia	J. W. Nicholson	J. J. Maxwell
" Italia	A. E. McGragor	R. E. Benham
Bge. Amazon	James O'Flynn	John Sandwick
" Polynesia	A. D. McKay	Peter Anderson
ISAAC STEPHENSON, MARINETTE, WIS.		
Str. I. Watson Stephenson	L. F. Strahan	Joseph Nold
GRAND TRUNK RAILWAY CO., WINDSOR, ONT.		
Str. Lansdowne	F. D. Forrest John Jackson	Joseph F. Taylor
Str. Great Western	M. Bausetto Alex Baillorgeon	William Belsom
Str. Huron	Hy Oldenberg	Joseph Ladds
CAPT. J. B. LOZEN, MGR., NEW BALTIMORE, MICH.		
Str. C. A. Street	Hector Brown	Charles E. Flanagan
Sch. J. B. Lozen	J. F. Lozen	
" J. Godfrey	Dick Moore	
M. A. HANNA & CO., J. S. ASHLEY, MGR., CLEVELAND, O.		
Str. George B. Raser	S. A. Cline	Edward Ball
SHANNON & GAREY, SAGINAW, MICH.		
Str. Homer Warren	A. T. Young	Charles King
" Robert Holland	William Lohr	L. Sleeno
Bge. Exile	J. H. Trudo	
" White & Friant	J. W. Hall	
" T. H. Cahoon	T. B. Garey	
" Ida Keith	Peter Trudo	
" B. B. Buckhout	Frank Waldorf	
CHARLES BEYSCHLAG, ST. CLAIR, MICH.		
Str. America	A. G. Tappan	Norton J. Maugh
EDWARD MEHL, ERIE, PA.		
Str. Niagara	D. A. Kendall	A. W. Turner
" Uganda	D. Elliott	Charles Nerreter
CAPT. W. J. WILLOUGHBY, WINDSOR, ONT.		
Str. Iron Age	W. J. Willoughby	Richard Baxter
SANDUSKY & ISLANDS AND SANDUSKY & PENINSULAR STEAMSHIP CO., SANDUSKY, O.		
Str. Lakeside	J. C. Fox	Philip Myers
Str. Arrow	W. G. Slackford	Jacob Weis
MERCHANTS LINE, MONTREAL, CAN.		
Str. City of Montreal	Arthur Lefebvre	Fred Hamelin
" City of Ottawa	I. F. Troevell	I. Kennedy
" Bickerdike	John Moore	Eugene Hamelin
CHARLES H. ELLIS, M. O., ASHLAND, WIS.		
Str. Hilton	Manning Kilton	
MACARTHUR BROS. CO., DETROIT, MICH.		
Str. Tecumseh	C. Beaupre	Dan Brisbin
WILLIAM LIVINGSTONE, DETROIT, MICH.		
Str. William Livingstone	William Norehead	Richard Sutliff
FARRAR TRANSPORTATION CO., COLLINGWOOD, ONT.		
Str. Meaford	F. A. Bassett	Duncan McLoud
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Str. Algomah	G. W. Boynton	Richard McLaughlin
" Duluth	A. Graves	J. Long
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C. F. Sainte Marie	L. R. Boynton	Richard Walsh
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" Greyhound	Thomas Meikleham	David Maxwell
" City of Toledo	John J. Stover	M. J. Gilligan
" Owana	Harry Tyrie	Charles H. McCarten
NIAGARA, ST. CATHARINES & TORONTO NAV. CO., LTD., ST. CATHARINES, ONT.		
Str. Garden City	D. J. Enright	James H. Brown
" Lakeside	N. J. Wigle	J. Abbey

CAR FERRY ONTARIO NO. 1 LAUNCHED.

The Canadian Ship Building Co. launched from its Toronto yard on Saturday afternoon a large car ferry for trading on Lake Ontario, between Canadian and New York ports. There was a large attendance at the launch including E. H. Fitzhugh, fourth vice president; J. W. Lond, freight traffic manager; W. E. Davis, passenger traffic manager; W. H. Bigger, K. C., general solicitor; W. D. Robb, superintendent of motive power; M. S. Blacklock, superintendent eastern division; Grand Trunk Ry. official from Montreal; W. L. Brownlee, superintendent G. T. R., middle division, and other G. T. R. officials from Toronto; A. G. Yates, president; W. T Noonan, general manager; J. F. Dinkey, treasurer; G. H. Clune, auditor and assistant treasurer; ——— Havens, attorney; J. M. Flosch, chief engineer, and J. B. P. Duffey, from Rochester, N. Y., representing the Buffalo, Rochester & Pittsburg Ry., which is jointly interested with the Grand Trunk Ry., in the Ontario Car Ferry Co., for which the steamer is being built.

The christening ceremony was performed at 3 o'clock, by Miss Fitzhugh, daughter of the fourth vice president G. T. R., who was presented with a bouquet of Richmond roses and maidenhair fern by the Canadian Ship Building Co. Ontario No. 1 was the name given to the vessel as she left the ways.

The ferry is of the latest model of car ferry construction, the cars being loaded and unloaded at the stern. The hull is of steel, length over all 325 ft.; beam 56 ft. She will have a draught when loaded of 15 ft., and will have a capacity for 26 cars and 1,000 passengers. The engines of the triple expansion type, will be capable of giving the vessel when loaded a speed of 15 miles an hour.

The Ontario Car Ferry Co. was incorporated under the Dominion Co.'s act in December, 1905, with a capital of $500,000 and offices at Montreal, with the object of operating car ferries on Lake Ontario between such points on Ontario and New York as might be expedient. The company was formed in the interest of the Grand Trunk Ry., and the Buffalo, Rochester & Pittsburg Ry. These companies at present carry a large tonnage of coal, the change from the latter line to the G. T. R. being made at Suspension Bridge. By establishing a ferry service between Charlotte, N. Y., and Port Hope or Coburg, Ont., or both, the railways will be saved considerable haulage.

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April 11, 1907.

ROOSEVELT ON SHIPPING.

President Roosevelt has written a letter to Congressman Pollard, of the first Nebraska district, in which he endorses the shipping bill in the most unequivocal terms. Whatever doubt President Roosevelt may have planted in the minds of adherents of this bill by his first message to congress, he has certainly removed them all by this letter to Pollard. It is an emphatic endorsement of the shipping bill. He thanks Pollard for his support of that measure and congratulates him and other western congressmen for taking a broad and patriotic view of the situation. He deprecates the defeat of the bill as a serious injury to the commercial interests of the United States. The president says in his letter to Mr. Pollard:

"I feel that it is due not only to you, but to the other western congressmen, the congressmen from the interior, who voted for the ship subsidy bill, that I should express to you, not only for you, but for all of them also, the reasons why I think you have rendered a great and patriotic service.

"At the outset, let me emphasize the fact that the present proposed ship subsidy bill has nothing whatever in common with certain previous measures of the same name. There were well founded objections to certain features of these previous measures, but in the present measure all these objectionable features have been eliminated. I should heartily favor the present measure in any event, but the experiences of Secretary Root on his trip to South America and the course of events on the Pacific seem to me to render it of the utmost consequence to pass the proposed bill. As a matter of fact, my only objection to it is that it does not go far enough. I personally, for instance, would like to see a line to South America from one of our Gulf ports.

"I feel that you men from the west who stood by the cause of American shipping in supporting the ship subsidy bill deserve the same praise that should be accorded to those men of the seacoast regions, who voted for and by their votes succeeded in establishing our present system of national irrigation in the states of Kansas, Nebraska and the Dakotas westward to California, Oregon and Washington. At that time the argument was made to me by many men representing the country east of the Mississippi that it was not fair to ask their support of a measure purely to benefit the states of the great plains and the Rockies. My answer to them was that anything that benefited a part of this country ultimately benefited all of it, and that we were in honor bound to support any such measure, even if our particular locality was not affected. The same argument applies now in reference to the shipping bill. It is deeply discreditable to us as a nation that our shipping should be driven from the high seas, and it has thus been driven partly because our steamship lines are quite unable to compete with foreign steamship lines, English, German, Japanese, French, which are heavily subsidized by their governments, and partly because the high standard of wages and of living which we exact for our seamen puts our ship masters and ship owners at a disadvantage when forced to compete even with unsubsidized ships of foreign powers. This difference in standards and the subsidization of our foreign competitors, taken together, have created an obstacle to the development of our shipping which is insurmountable except by a subsidy, and this obstacle must be cleared away as we would clear away a bar from the mouth of a river.

"I felt that the loss of the ship subsidy bill at the last session of congress was a real blow to our country, and that it was particularly to be regretted because it has tended to dampen some of the enthusiasm for closer relations with this country which Secretary Root's visit aroused in South America."

The real support of the shipping bill in congress must come from the west. Eastern support is usually confined in the layman's mind with personal gain; but western support is entirely free from that suspicion. President Roosevelt takes the right view of it when he compares aid to shipping with government improvement of arid lands. Viewed closely it might appear as though the reclamation of desert lands benefited chiefly those whose property abutted upon them; but productivity cannot be introduced into a considerable part of the country without benefiting the entire habitants thereof. To make the desert lands contribute to the needs of mankind is to lower the cost of the necessities of life. The cost of any article cannot be lowered without a corresponding increase in the field of its usefulness. Time was when only the wealthy drank tea, but there is not a family now that lives without it.

The opening of trade routes to coun-

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tries not at present reached by American steamers must inevitably add to the wealth and prosperity of the United States. Probably if the money employed in the building of a single ship could be traced throughout all the avenues of trade, it would be found to reach into the life of every family. A ship is as complex as a city, for in its creation and sustenance it requires all that a city needs. In embryo it lies in the hills of Lake Superior and it follows an evolution as wonderful as any process of nature in its gradual transformation into a ship. When done the cost has been mainly labor. How completely must the building of twenty ships vivify industry.

When the protective policy was made in this country it was the intention of its projectors that shipping should be included. Shipping, however, was not included, which is the reason that it has languished and practically disappeared, while every other enterprise of industry has prospered. The artificial handicaps which have been imposed upon shipping should be compensated by further artificial advantages. If the American ship cannot live upon the high seas without subsidy, it should be given a subsidy. It is criminal that the present state of things should exist.

FREIGHT SITUATION.

"When will you open navigation? Answer quick" was a telegram which a leading operating company received from New York last week. As that act is exclusively the province of the Great Disposer, the company was unable to answer. Navigation will open as soon as the ice clears out of the channels. None of the leading owners is inclined to force a passage. The ice in St. Mary's river is still solid and those that started out their vessels for the head of the lakes a week or more ago have gained no advantage. It is not likely that a general start will be made for the head of the lakes until the latter part of next week. Weather in the Lake Superior region has been cold and disagreeable and very little ore has gone forward from mines to dock. It is not probable that any ore will be loaded at the head of the lakes until next week, as there is little satisfaction in attempting to handle the frozen product. A few large carriers have left Lake Erie ports with coal for Lake Michigan ports. Some difficulty was experienced by the vessels which left Buffalo, but they are not likely to meet with further adventure on the trip as the straits are fairly free from ice. Owners are conservative, however, and have instructed their masters to take no chances in the ice. There is reason for this, as the ship yard strike must naturally make delay in executing repairs. The ship building companies have the moral support of the vessel owners in their present struggle with labor. The present tonnage is ample for 1907 business and owners are not pressing for either old or new work. The union has suffered by not being able to control the unruly element in its ranks from resorting to violence. If the truth could be got at it would probably be discovered that four-fifths of the workmen regret the strike.

When the season opens everything will be in readiness to transact an enormous volume of business with dispatch. During the winter dock equipment has been considerably added to, and the practice will probably be common of unloading a 10,000-ton steamer in a working day. Ore has been moving freely from Lake Erie docks to furnaces and they will be fairly free from ore when the first cargoes arrive. The executive committee of the Lake Carriers' association will conclude its final arrangements with labor aboard ship within the next few days. There is very little left indeed, having simply the firemen's union and seamen's union to deal with. The dock managers have settled their affairs with the longshoremen. Only minor differences had to be adjusted, the wage scale and hours of labor having been determined upon last year.

PIG IRON SITUATION.

More positive indications of a continuance of the present prosperity were present in the iron and steel market during the week under review. The contention of large independent steel interests that they would not pay more than $20 per ton furnace for last half iron seems to have been abandoned, and sales aggregating 250,000 tons at $21 furnace have been made. There is a persistent demand for pig iron in both Germany and America in the Middlesboro, England, district. Great improvement is shown in structural material, and some heavy orders have just been placed. The sheet mills are falling far behind in their orders, while there appears to be no let-up of new business. The monthly blast furnace statistics reveal a remarkably good record, considering the enforced idleness of several days of many stacks, due to the floods in the Pittsburg district. The production in March was 2,186,709 tons, compared with 2,047,036 tons in February.

MR. COULBY RETURNS.

Mr. Harry Coulby, president and general manager of the Pittsburg Steamship Co., returned from England last week. During his stay abroad he made an inquiry into the present state of the steam turbine with especial relationship to its employment on freight carriers, but found that it is still in an experimental state insofar as low power is concerned. The turbine does not operate economically at low speeds, consuming as much coal as when operating at higher speeds. There is, however, a saving in oil, but oil consumption on a lake freighter is an inconsiderable item. Mr. Coulby from his investigation was convinced that the low power triple-expansion engine now in common use on the lakes is the most satisfactory yet devised for moderate speeds, consuming the minimum of fuel and moving its freight at a lower cost per ton per mile than is known anywhere else in the world. He says that he made a number of observations which he will discuss with his masters later.

DREDGE OWNERS' CONFERENCE.

Probably no class of capital in the world is quite as much beset as the dredge operators. Not alone have they to meet private competition, but government competition as well, to which must be added regulations as to hours of labor which lack the flexibility absolutely essential to the profitable management of any private enterprise. The dredge owners and delegates of the Dredge Workers' Protective Association are in conference this week endeavoring to reach a common agreement. The operators have offered the men a general advance in wages of about 10 per cent at last year's hours. The men worked twelve hours last year, but now demand an eight-hour day on government work and a ten-hour day on private work. This is reducing hours of labor one-third and one-sixth in a season that is naturally short. The dredge operators maintain that their plants cannot be economically worked in such short shifts. The case would be altered were it possible to work all the year round, but there is a long winter season on the lakes when no work can be done. The conference will probably last the remainder of the week.

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CONCRETE ORE DOCK FOR CLEVELAND FURNACE CO.

One of the first reinforced concrete docks to be built for ore docking is now in process of construction at the plant of the Cleveland Furnace Co., Cleveland, on the Cuyahoga river. The dock, which has been designed and is to be built by the Carey Construction Co., Cleveland, is one of the many improvements now being undertaken on the river to provide better facilities for handling the ore at that port. At present the Cleveland Furnace Co. maintains an unloading plant and dock near the mouth of the river where the dock is accessible to boats and from that point the ore must be transported in cars by rail to the furnace much farther up the river and again unloaded into the yard where it is kept in stock. According to present plans, the river channel is to be deepened to permit of navigation as far up as the Cleveland furnace, and in consequence, the company is now improving its dock facilities at its plant, so that the ore may be unloaded directly from the boats to the stockpile.

This means that the river front at that point must be filled in and a dock built, so that there will be sufficient depth to accommodate the draught of the ore carriers. The design of the reinforced concrete work is shown in the accompanying drawings, and as indicated, 14-inch wooden piles tapering to 6 inches have been driven as the supporting foundation. These piles are in alluvial soil with the exception of 4 feet of slag fill on the surface. The existing dock on which the concrete work must be built consists of a line of sheet piling approximately 11 ft. back of the new center line of the rails on which the unloading machine will run. Back of this sheet piling is an earth fill through which run rods tying the sheet piling to 20-foot anchor piles. Anchorage to the old dock is obtained, as indicated in the drawing, through 16-in. reinforced concrete webs spaced every 15 ft. and tied to the sheet piling, and will take care of whatever outward thrust is put upon the dock by the ore piles loaded on it.

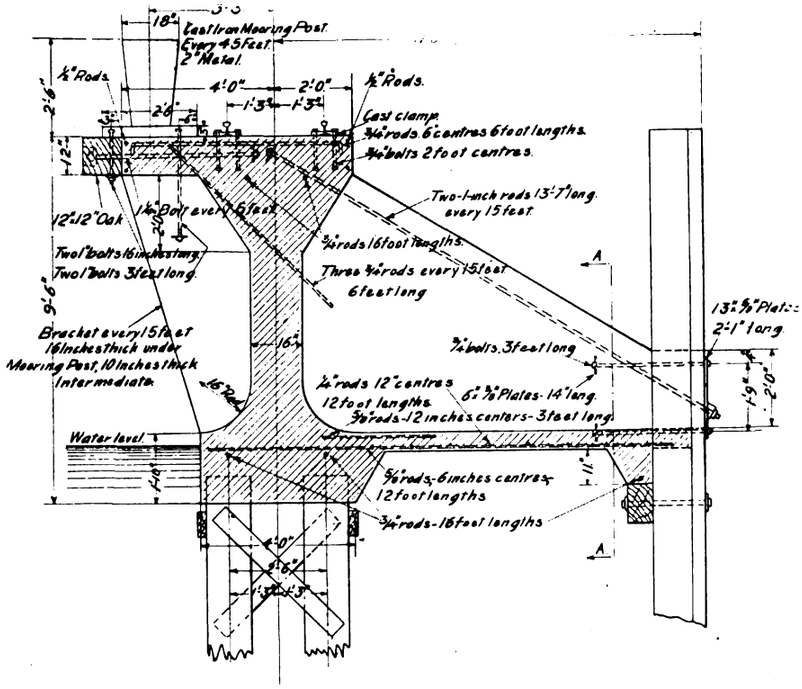
Cast Iron Mooring Post Every 45 Feet 2" Metal
½" Rods
4'0"
2'0"
1'3½"
Cast clamp
¾" rods 6 centres 6 foot lengths
¾" bolts 2 foot centres
Two 1-inch rods 13'7" long every 15 feet
12"x12" Oak
Two ¾" bolts 16 inches long
Two ¾" bolts 3 feet long
¾" rods 16 foot lengths
Three ¾" rods every 15 feet 6 feet long
Bracket every 15 ft. of 16 inches thick under Mooring Post, 10 inches thick Intermediate
16" Rod
¾" bolts, 3 feet long
¾" rods 12" centres 12 foot lengths
6"x⅜" Plates 14" long
¾" rods 12 inches centers 3 feet long
Water level
¾" rods 6 inches centres 12 foot lengths
¾" rods 16 feet lengths
A

FIG. 1.—CROSS SECTION OF CONCRETE ORE DOCK.

Wooden piling has been used instead of concrete, because of the initial cost, a difference in favor of wood of about $6 per foot existing between the two designs. The difference between the strengths of the two forms of construction is indicated by the fact that a concrete pile has a 21-in. bearing surface at the top and is 32 ft. deep to carry the same load as the wooden pile 14 inches in diameter and 42 ft. deep. As shown, the piles are to be driven with 2-ft. 6-in. centers.

The dock is designed to carry one end of the unloading plants, the rails shown in the sketch indicating the location of the runway, and to stand a wheel load, including the wind load, of 53,000 pounds, the wheels being 2-ft. 6-in. centers. A possible condition has to be provided for, however, where four wheels 4-ft. centers are all on the dock at one time. Web reinforcement is also provided to take up

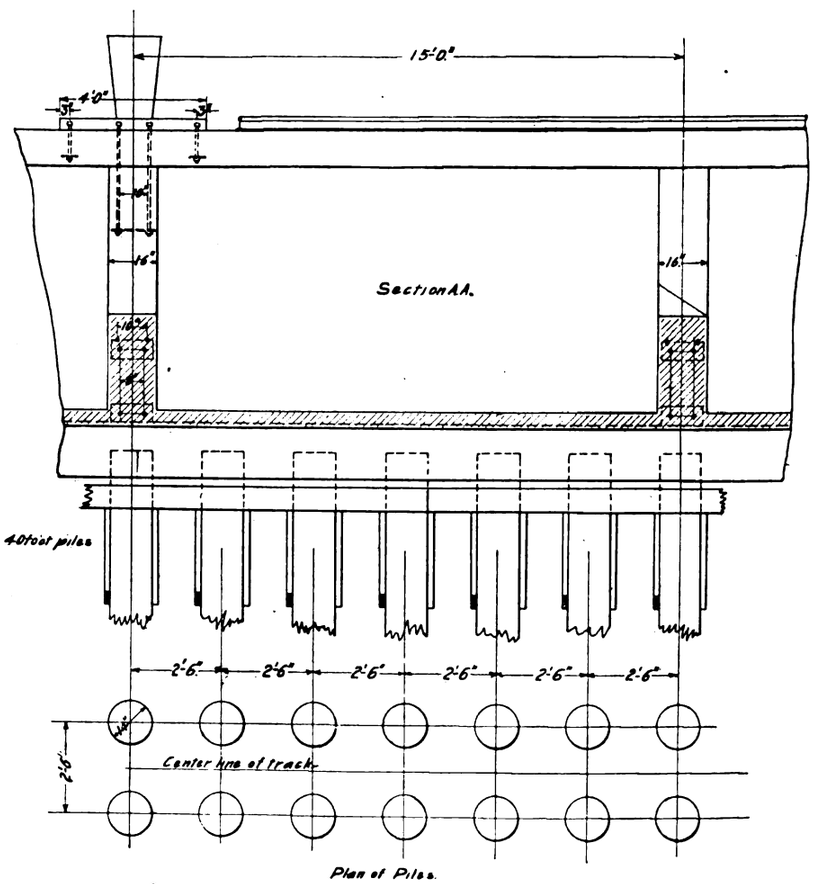

FIG. 2.—PLAN AND SECTIONAL ELEVATION OF CONCRETE ORE DOCK.

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the shock from the wooden bumper caused by boats striking the dock in landing. The space between the new concrete dock and the old sheet piling is to be filled with slag. This slag filling and the slag sand for the concrete, which is to be a 1, 2, 4 mix, is furnished by the Cleveland Furnace Co. at a cost of 25 cents per yard. A considerable reduction in cost will result, therefore, as this is cheaper than ordinary sand, which costs about $1.30 per yard. The entire cost per foot of the dock is $25.70, which includes the price paid to the furnace for the sand, cost of piling and 12 x 12-inch oak bumpers. While the wooden piling has been guaranteed to stand the load, its guaranteeing is not assumed by the concrete builders and does not enter into the guarantee for the concrete work. However, there is no reason for anticipating the failure of the wooden piling and the reduced cost is a considerable item.

The present dock is to be 1,000 ft. long and, in the event of its success, will probably be followed by the building of added sections. Cast iron mooring posts with 2-in. metal have been located every 45 ft. and the surface of the dock is 7 ft. 8 in. above the ordinary water level. Such a dock presents features of low cost, largely due to its design, strength and durability and there is every reason for looking to a larger use of reinforced concrete for similar purposes in the future.

DECISIONS WHICH AFFECT SHIPPING INTERESTS.

SALVAGE SERVICE.—A steamer, having broken her shaft, was floating helplessly on the Ohio river, when she made signals of distress to a steamboat, in response to which the latter made fast its tow and went to the disabled steamer's assistance. The disabled steamer was without means to get out a line, and was in grave peril of drifting against the wall of a dam, or other obstruction below, when the vessel took her to a landing. The circuit court of appeals for the third circuit held that the services rendered was voluntary and constituted a salvage service and that the life boats were entitled to an award of at least $100.

COLLISION—LOOKOUT. — The United States court for the eastern district of Virginia holds that all that the law requires with respect to a lookout is that there shall be someone properly stationed to best observe, see and hear the approach of other vessels; and that a small launch, 61 ft. long, having her pilothouse, in which her navigator stood, well forward with open windows all around, and other members of the crew on the deck, cannot be held in fault for a collision in the day time in fair weather, because she did not have a lookout specially stationed, where she was the privileged vessel entitled to keep her course and speed, and the absence of such lookout did not contribute to the collision.

COMPENSATION FOR SALVAGE.—On Oct. 1, 1905, the steel steamer Peter White, 524 ft. long and valued at $330,000, bound for Duluth, was disabled in Lake Superior, 60 or 70 miles east of that port, by the breaking of her crank shaft. The water was rough and the wind was blowing 20 miles an hour and afterward increased. She lost her port anchor and was drifting at the rate of four miles an hour toward Outer island, 30 miles distant. After six hours the steamer Troy, bound from Duluth, sighted the distress signal of the White and went to her relief, towing her to Duluth at a loss of 16 hours from her voyage. The Troy was also a large steamer, valued at $325,000, with a cargo of $250,000. There was some risk in making fast the hawser which necessitated going quite close to the White. During the six hours preceding the coming of the Troy, which was at noon, no other vessel had passed. In a suit for salvage the court held that, considering all the facts and the considerable peril of the White, the Troy was entitled to a salvage award of $5,000, one-fourth to her officers and crew.

AIR PRESSURE IN FIRE ROOMS OF MINNESOTA.

Among the conditions imposed in the four-hour trial of the United States battleship Minnesota were a speed of 18 knots with an average air pressure in the fire rooms of not more than 2 in., and a maximum air pressure of 2¼ in. The forced draft equipment comprises twelve Sturtevant fans, each 5½ ft. in diameter, driven by 6 x 5 double cylinder engines. The official report shows that the average air pressure required to obtain the desired results did not exceed 0.94 in. of water, with a blower speed of 349 revolutions, while the speed of the ship attained 18.851 knots. The usual closed fire room system was employed, the air being forced into the rooms under pressure with the above results. The following average record of temperature shows the beneficial effect of positive air circulation:

Atmosphere	58.7
Engine rooms, working level	78.4
Fire rooms, working level	85.3

SUBMARINE SOUND NOTES

The Plymouth (England) Chamber of Commerce has asked the Associated Chambers of Commerce of Great Britain to urge the universal adoption of submarine signaling, to be paid for by the national exchequer.

The new steamer Rotterdam, 24,000 tons, building by Messrs. Harland & Wolff, of Belfast, for the Holland-American line, will be equipped with submarine signals.

The Shipping Federation of Canada has made official request of the Dominion government to establish submarine signals at 23 points in the St. Lawrence, the Bay of Fundy and on the Nova Scotia coast.

The North German Lloyd, the Hamburg-American and the Holland-American lines have approached the French government with a request that they equip the French harbors of call with submarine signals.

Capt. G. F. Coffin, of the Commercial Tow Boat Co.'s tug Dudley Pray, reports that he considers submarine signals a great aid to navigation, because on March 23, 5 a. m., when approaching Cornfield Point lightship in fog he picked up the sound of the bell very distinctly; passed the lightship at 6:10, and carried the sound till 6:33; speed five knots.

A "Notice to Mariners," issued from the hydrographic office of the admiralty, under date of March 8, intimates that it is intended by the Netherlands government to establish submarine fog-bells on the North Hinder, Schouwen Bank, Maas, Haaks, and Terschelling Bank light vessels.—*Shipping Gazette*, March 14.

Lloyd's Gazette of March 4, says: "The Red Star Liner Vaderland, of 12,018 tons, has happily made but a short stay on the Goodwins, where she was reported aground late last night. Such a casualty as this—and, indeed, other strandings which have occurred in these narrow waters during the recent foggy weather—would probably have been avoided were submarine bells employed on the lightships in the locality."

Washington Associated Press dispatches, dated March 20, say that Capt. Adolph Marix, U. S. N., who has charge of all the naval colliers, made a trip from Boston to Baltimore on the Merchants & Miners steamer Ontario to observe the working of a submarine signaling. On the trip down the coast the Ontario exchanged tests with the lightships on Boston, Pollock Rip Shoals, Winter Quarter Shoals and Cape Charles stations, and it is stated that the practicability of the new safety device was fully demonstrated. Capt. Marix will embody the result of his observations in a report to the navy department.

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CAPT. H. J. REAGAN.

Capt. H. J. Reagan, one of the most popular captains of the Pittsburg Steamship Co.'s fleet, will sail the reconstructed steamer Mataafa this season. Capt. Reagan was born at Walkerville, Ont. During the Boer war he enlisted in the Gordon Highlanders and went to the

CAPT. H. J. REAGAN.

front with the first Canadian contingent with whom he served through some of the fiercest engagements of that sanguinary conflict. On his return to the lakes he shipped as mate in the Bessemer line and served in that capacity until promoted to sail the John B. Trevor. Afterwards he sailed the Matoa and the Corsica.

AROUND THE GREAT LAKES.

Capt. Charles Motley opened the life saving station at Cleveland on Tuesday of the present week.

The wooden steamer Walter Vaile has been sold by H. J. Pauly of Milwaukee, to J. A. Calbick of Chicago.

The plant of the Jenks Ship Building Co. at Port Huron, was damaged to the extent of $4,000 by fire recently.

Manager Frederichs of Traverse City has purchased the excursion steamer Chequamagon for use on Traverse Bay.

Sydney O. Neff has bought the freight steamer Omaha from Frank W. Smith, and the steamer Wm. E. Fitzgerald.

Nelson J. Gaylord, Ludington, Mich., has been awarded contract for repairing the south pier of Muskegon harbor. His bid for the work was $15,852.86.

The dredge hull which the Port Huron Construction Co. is building is for the St. Lawrence River Power Co., of Pittsburg.

The steamer Fred Mercur has been sold by the Tonawanda Iron & Steel Co. to John Hall of Ogdensburg, N. Y.

Mr. W. B. Linsey, superintendent, and W. F. Look, dock agent for the Chicago Northwestern Railroad at Escanaba, were in Cleveland last week.

Beginning April 15 the clearance office at Buffalo will be open twenty-four hours a day. This will be a great accommodation to shippers and vessels.

Capt. W. D. Brent, of the Susquehanna Coal Co.'s tug Tacony, reports hearing Boston light-vessel submarine bell seven miles, on March 11, in a snowstorm. The direction was good and he ran to the lightship by the bell.

The Moore & Scott Iron Works, San Francisco, were the lowest bidders at $18,623 for repairing the French bark Boieldien. Other bidders were Boole & Sons, $30,550; Risdon Iron Works, $25,989; Union Iron Works, $25,455.

The C. Reiss Coal Co. will rebuild and enlarge the coal dock of the Chicago-Northwestern Railway at Manitowoc after navigation closes. The structure will have a storage capacity for 500,000 tons and will be the fourth big modern dock for Manitowoc.

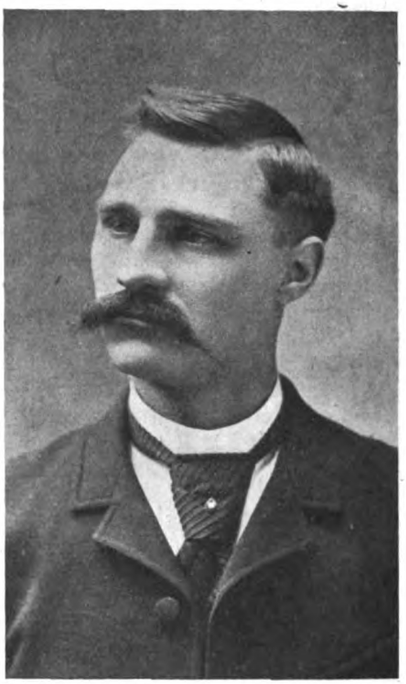
The lumber carriers at a meeting of the association held at Detroit, fixed the rate of lumber from the head of the lakes at $2.50. A profitable season is looked forward to by the owners of these vessels, owing to the wastage of the fleet caused by the elements and the subtraction of available tonnage caused by purchases from the coast.

The steamer N. J. Nessen has furnished the first marine disaster of the season. Coming down the south arm from East Jordan with hard wood lumber the Nessen was cut through by the ice and went down in two minutes. The wreck is about a mile above Ironton and is in 30 ft. of water. The Nessen was owned by J. O. Nessen & Co., Manistee, Mich. Her cargo of lumber was owned by the East Jordan Lumber Co. The Nessen was built in 1880 and was 137 ft. long and 37-ft. beam.

The fleet engineers of the Lake Carriers' Association are in session this week with Capt. James Stone, supervising inspector of steamboats. At the annual meeting of the board of supervising inspectors a year ago some regulations were made which the fleet engineers believe to be onerous when applied to lake ships. One of them is the placing of a large hand pump on all steamers forward. The fleet engineers claim that this pump is wholly unnecessary.

CAPT. WILLIAM MOREHEAD.

Capt. Wm. Morehead is to sail the steamer Livingston the coming season. This is Capt. Morehead's first command, he having been mate in the United States Transportation Co.'s fleet the past four years. Like many another steamboat man, he was born at Sombra, Ont. He



CAPT. WM. MOREHEAD.

began his sailing career on the steamer Isaac May as second cook. In 1898 he retired and turned from plowing the raging main to plowing the fertile soil of Kansas. A few years on the farm, however, proved sufficient, and he returned to the more congenial occupation of steamboating.

The Empire Ship Building Co. has secured the contract for the cutting off of 30 ft. from the bows of the steamers Bombay, Baroness and Bay City for their journey through the Canadian canals to the coast. These vessels with nine other whalebacks were sold a couple of years ago by the Pittsburg Steamship Co. to the Boutell Steel Barge Co., which has subsequently disposed of them to coast interests.

BIDS FOR REVENUE CUTTER TUGS.

Bids were recently opened for the construction of an ocean-going tug for the north Pacific coast by the revenue cutter service. The bids were as follows: The Pusey & Jones Co., Wilmington, Del., $189,057; The Maryland Steel Co., Sparrow's Point, Md., $226,200.

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A TRAVELING CANTILEVER CRANE FOR SHIP YARD USE.

The accompanying illustrations show a traveling cantilever crane recently built by the Wellman-Seaver-Morgan Co., Cleveland, for the Mare Island navy yard, California. The crane runway is located between two building slips in one of which is to be constructed the collier authorized at the first session of the last congress.

The crane runway is 613 feet long and has an average height to top of rail of 69 feet. The gage of the rails on the runway is 20 feet. The cantilever has a total span of 224 feet, and a total trolley travel of 218 feet. The lower chord of the crane is 32 feet above the runway rails. The crane capacity is 30,000 pounds at 60 feet distance on either side of the runway, and 15,000 pounds throughout the whole length of the crane arms. Hoisting can be done at three speeds: 30,000 pounds at 100 feet per minute; 15,000 pounds at 200 feet per minute; or 5,000 pounds at 500 feet per minute. The trolley movement has a speed at full load of from 400 to 600 feet per minute, while the crane can travel along the runway under full load at a speed of from 400 to 600 feet per minute. In calculating these speeds, an allowance was made for the pressure on the load due to a wind of 35 miles per hour. All three motions can be used at the same time.

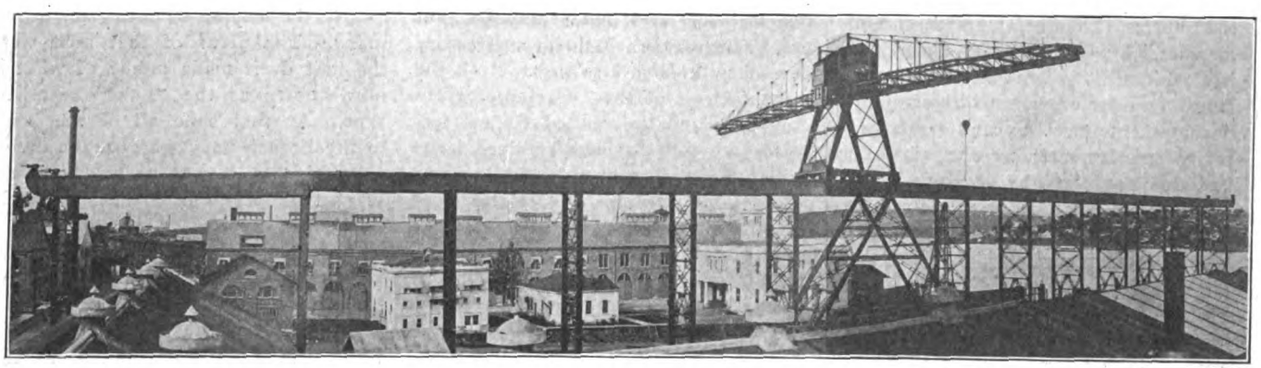

FIG. 1.—CANTILEVER CRANE AT THE MARE ISLAND NAVY YARD.

Three motors are used, each using direct current at 220 volts. This current is supplied by a pair of rails situated between the main crane runway rails, as shown in Fig. 2. The hoisting motor is compound and of 150-horsepower. The trolley motor is of 40 horsepower. These are installed in the operator's cage on a level with the crane arms. The bridge motor for causing the crane to move along the runway is of 100-horsepower, and is located in a small motor house shown at the base of the crane tower. All three motors are controlled from the operator's cage by means of magnetic clapper switches installed by the Electric Controller & Supply Co., Cleveland.

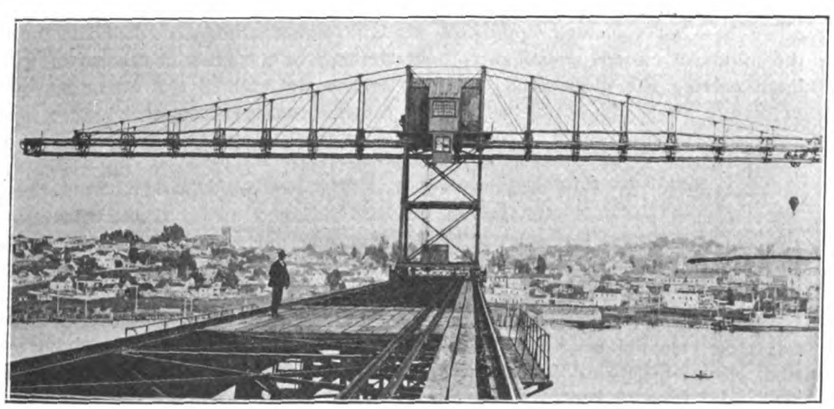

FIG. 2.—RUNWAY AND BRIDGE OF MARE ISLAND NAVY YARD CRANE.

The device shown in Fig. 3 is used to guard against tilting of the crane when it is carrying a load at its extreme reach. A wheel bears against the under side of the upper flange of the runway girders, being driven from the axle of the traction wheels at the same speed at which the crane travels. Normally this does not bear against the girder, but any tendency to tilt brings it in contact with the upper flange and thus steadies the crane.

The runway is supported by pin-connected bents on pile and concrete foundations. The main support, however, is an A-frame, located at the middle point of the runway. The runway is free to expand either way from the A-frame. Spring buffers at either end of the runway provide against over running of the crane, and also automatically shut off the current from the motors when the crane comes in contact with them.

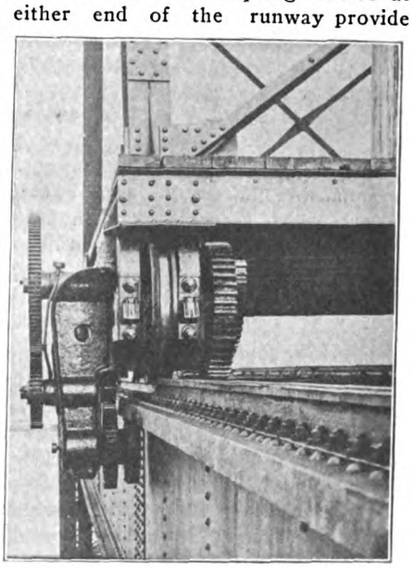

FIG. 3.—DEVICE TO PREVENT TILTING.

The Crosby Transportation Co. has chartered the steamer Kansas of the Northern Michigan Transportation Co.'s fleet and will operate the boat on the Muskegon-Grand Haven route.

The lighthouse department is placing gas buoys and stakes in Lake St. Clair and St. Clair river and will finish the work within a day or two.

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DEVELOPMENT OF SUBMARINES.

One of the most important papers read at the annual meeting of the Society of Naval Architects and Marine Engineers in New York was upon the subject "The Development of Submarines," by Lawrence Y. Spear, who has, himself, given several years' study and experience to their actual development. Mr. Spear's paper was really supplemental to one which he had delivered before the society four years ago, in which he reviewed development up to that time. He related the development which has taken place in Great Britain, France, United States, Russia, Japan, Italy, Holland and Germany. Mr. Spear's paper provoked much discussion, that of Mr. Simon Lake being quite spirited.

DISCUSSION.

Mr. W. D. Forbes—It is quite natural that when anything, military or civil, is being developed, that failures and troubles are not made public. In other words, gentlemen, that great educator, the scrap pile, is not worked as it should be for real information; it is an educator we all neglect. I suppose it is pride which keeps us from saying more about it. We have heard of the advantages of submarines in this paper, which seems to go so much further than anything ever presented before, that I think its value is great, but would like to ask the author if any comparison could be made between the danger of running, say torpedo boats on the surface and handling submarines. Can the danger in the submarine be properly gaged? Is not the danger in the submarine so great that it will be a grave question whether it can be made practicable at all times on account of most people being very much more frightened by something they do not thoroughly understand than when they really know what is coming. The newspaper reports are very conflicting, and I suppose quite inaccurate, but I would like to get such information if it is possible, concerning the accidents in comparison to the number of boats which have been handled.

Capt. William Hovgaard—I would like to ask Mr. Spear which are the difficulties which are met with in the use of ordinary petroleum motors instead of gasoline motors for submarine boats? I have already, four years ago, expressed my objection to the use of gasoline for this purpose on account of the dangers which are involved thereby. Ordinary oil, being less dangerous, would be preferable. I understand that the English are trying to produce an oil motor suitable for this purpose, and that they have not yet succeeded; but, it appears that the French have obtained satisfactory results with Diesel motors. Both the main factory of the Diesel motors in Augsberg and the related French factories are said to have received large orders for such motors for submarine boats. The German firm, Korting, has constructed a petroleum motor for the Russian submarine boats, and this type is said to be very successful. Perhaps Mr. Spear can explain what are the difficulties met with in this problem.

Mr. Simon Lake—Some of Mr. Spear's statements are made, perhaps, through lack of information regarding the "Lake" type of boat. It is, perhaps, unfortunate from a scientific point of view that business reasons have made the builders of submarine vessels unwilling to give to the public either complete descriptions of their boats or full details of the vessels built by them. Of course, the prime reason for thus withholding information has been the effort to prevent the pirating of features probably developed at great expense. This secrecy has led to much confusion in the minds of casual investigators bent upon solving the merits and demerits of the various types of submarine craft now forming part of the navies of the world. The speaker has been no exception to this general rule. Therefore, it has been impossible for the general public, or business rivals, to learn of all the good features which exist in the different types.

It is not my purpose to take up the society's valuable time with a discussion of the merits or demerits of any particular type of boat. I take pleasure in giving to the members of this society a few scientific facts, both as to the construction and performance, of the even-keel type referred to. I shall confine myself principally to the features touched upon in Mr. Spear's paper, those relating to certain performances of the Protector, and to various deductions he has made in reference to buoyancy, stability, speeds and general capabilities of the "Lake" type. To give a clear conception of these important features it is necessary to describe briefly the development of this type.

In 1893 there was submitted to the United States navy department the first design of a purely level-keel boat. This boat contained the principal elements which go to make up the equipment of the most successful submarines in the leading navies of the world today. The plans of that boat were the first draft made public of what is now known as the "Lake" even-keel type. At that time all of the boats in the French navy were of the diving type; that is, it was necessary to depress their longitudinal axes from the horizontal in order to get them under water, The Peral, of the Spanish navy, was of the diving type. The Holland boats in this country have all been of the diving class and were controlled in a manner similar to that of the earlier French boats.

The novelty of this level-keel boat consisted primarily in providing the vessel with a double hull and in giving her wheels with which she could either run upon the bottom, or which prevented collision of the hull itself with the bottom, while still affording a means of contact with the bottom as a guiding medium—the hull of the boat floating submerged a short distance above the water-bed.

Its novelty consisted further in providing a diving compartment which offered certain military advantages, and which would afford means for the escape of the crew in case of injury to the main hull of the boat, or should she become entangled while submerged and be unable to rise to the surface.

The novelty further consisted in providing a heavy keel which could be released in time of accident, thus permitting the vessel to rise quickly to the surface.

A further novelty lay in providing automatic appliances within the boat for maintaining a level keel, appliances that were designed to counteract any tendency to change trim, should members of the crew move forward or aft while the boat ran in a submerged condition and in suspension.

A further novel feature was the application of side submerging and leveling vanes. These submerging vanes, or hydroplanes, were for the purpose of overcoming the boat's reserve buoyancy, and the leveling vanes, or horizontal rudders, were for the purpose of assisting in maintaining a level keel when running submerged. An automatic safety appliance was provided to prevent the vessel from sinking below a predetermined depth. The vessel was designed to operate on the

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surface, between the surface and the bottom, or on the bottom itself.

This design had for its primary object the construction of a boat that would not tip up on end, as was proved to be the tendency of practically all of the diving boats built up to that time; she was to be readily controlled in a vertical plane and was designed to allow a free movement of the crew while running in a submerged condition.

I have been informed that that design was at that time favorably considered by a number of naval officers of high rank and responsibility, but as the designer did not have a company back of him ready to assume responsibilities incident to construction, and as he had no representative to properly place the case before the department, it was finally decided to build a vessel of the diving type. Contract for that vessel was awarded early in 1895, under an appropriation of $200,000, and upon the guarantee of performance made by the promoters of that particular type. Work on this vessel, with various changes, continued until 1900, when she was finally abandoned, never having made a submerged run.

On learning that the contract had been awarded for a boat of the diving class, a company was organized to build an experimental boat with which to demonstrate the practicability of certain of the novel features of the design as submitted to the navy department in 1893, a fairly full description of which appeared in the *New York Tribune* of October 22, 1894. This experimental vessel was known as the Argonaut I and, according to French authority, it was her success which led the minister of marine then to recommend the construction of the Narval, their first so-called "submersible." It later developed that the Narval was in many particulars similar in design and method of operating to that of the level-keel design, as submitted to the United States navy department in 1893. This was notably so in that the French abandoned in the Narval the exclusive use of the stern rudder for diving purposes and had substituted the side hydroplanes. They also lowered the center of gravity of the boat by adding a drop keel and the hull was of double construction. She was launched, as Mr. Spear has stated in his article, in 1899, nearly six years after the plans of the first "Lake" even-keel submersible had been submitted to the United States navy department.

In 1900, after the failure and abandonment of the government's first diving submarine, interest in the even-keel type was aroused in Washington and a representative of that type was asked to appear before the board of construction that he might explain the merits of that type of boat, the success of the experimental boat, the Argonaut I, having led a number of the officials to believe that the problem of successful submarine navigation had finally been demonstrated. The designer of this type was very glad to appear before the officials of the department, and later took with him a model and plan for three different sizes of submarine torpedo boats. The members of the board of construction at that time were as follows: Rear Admirals Charles O'Neil, George W. Melville, Francis T. Bowles, Royal B. Bradford, and Captain Charles D. Sigsbee.

The encouragement given by the members of the board of construction, in the form of a personal approval of the plans and the principles of said type, was sufficient stimulus to lead to the construction of the Protector, several times referred to in Mr. Spear's paper. The members of this society here present, will easily understand how much weight the opinion of the chief constructor then carried with the designer of the level-keel type, an opinion which was subsequently confirmed in his testimony before the house naval committee in May, 1902. He said: (See H. R. document No. 123.)

"The design includes some features that are different from the Holland boat, and some that are additional. Of the two principal features of difference, one is the method by which the Lake boat changes level when under way. That is a difference in principle. Most people who study the submarine boat hold the opinion that it is better to change levels while under way by maintaining a level keel, and that would be by the use of what are called hydroplanes."

The chief constructor further said:

"In regard to the Lake boat, I have listened to Mr. Lake describe his boat twice, and I have made an examination of the plans which he submitted. I have not gone so far as to express an opinion upon the *boat*. I feel, however, that the principles upon which Mr. Lake has designed his boat are *those usually recognized as correct*, and that the success of his boat depends entirely, as it does particularly for all submarine boats, upon the successful working out of the details to represent his ideas; *and upon that no one can express an opinion until the boat has been tried*."

Before the Protector was completed an appropriation was passed calling for competitive trials of submarine boats in order to determine the respective merits of the rival boats then under construction in this country. On page 17 of his paper Mr. Spear says, in speaking of the Protector:

"Although originally entered she was eventually withdrawn by the owners without trial."

This calls for an explanation. The Protector was ready for trial early in June, 1903, and the navy department was so advised. The owners of the Protector, referred to by Mr. Spear, made every effort to secure a competitive trial with any one of the diving boats then in the United States service, but the naval authorities were reluctant to do this so long as the Holland Torpedo Boat Co. promised to complete its boat, the Fulton, in time for competition within the term provided for by the appropriation. When the Lake Torpedo Boat Co., after an expensive delay of some months, again sought the department to give the Protector an immediate trial, the secretary of the navy called for the president of the board of inspection and survey Capt. C. J. Train. Congressman E. J. Hill, of Connecticut, said to the secretary of the navy and Captain Train, as Mr. Hill has testified: (See Congressional Record).

"Gentlemen, I ask you now to carry out the spirit of the legislation of last year and put a government boat in this competition; you have six of them. Captain Train replied to me: '*It is absolutely useless. I am ready to admit now that the Protector outclasses anything that the government has.*' That was the reply made to me in the presence of the secretary of the navy. I then said: 'Go on with your competition on the 16th of November.' On that date Mr. Lake's boat, the Protector, was at Newport, not towed there by somebody else, but going under her own power from Bridgeport, Conn., to Newport, and towing a schooner all the way in addition."

There were three boats of the Adder type in commission at Newport at that time, but the department would not assent to a competitive trial, as testified to by Mr. Hill, the secretary of the navy and Captain Train having opposed such a competition on the ground that the Holland Co. had requested further delays in order to make changes and improvements upon the Fulton.

On page 18 Mr. Spear refers to inferior speed results of the Protector as follows:

"These inferior results as to speed were ascribed by the inventor to a defect in the design of propeller, but as substantially the same results were later achieved in Russia, after the propellers had been changed, and as these data are verified by results obtained from sister ships, they must be accepted as the best of which the design is capable."

In the preliminary trials of the Protector, before her first propellers had been injured, she developed over a measured mile course a speed of 10.65 knots on the surface and showed something better than 6 knots submerged. The propellers were 45 in. in diameter, and as they showed considerable slip—in fact, over 35 per cent—it was considered advantageous to change them. Accordingly, one of the propeller experts of one of the largest and most experienced propeller manufacturers in the United States was consulted. He gave the opinion that the propeller did not have sufficient diameter and blade area and stated that the best results could be obtained only by considerable increase in each of these particulars. In ac-

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cordance with this expert's advice new propellers were ordered, but the result was very unsatisfactory. I am sure every member having to do with propeller problems will realize that it is a common difficulty with no particular reference to the submarine problem as a whole.

The propellers for the Protector, just described, were fitted to her the day before she left Bridgeport for Newport, in November, 1903. Having no time prior to that long run to try out these new screws, it was not until after reaching Newport that it was discovered that screws No. 2 were not nearly as good as the boat's first propellers. It was the results secured with screws No. 2 that Mr. Spear has used in his paper before this society, and upon which he has based all of his deductions in reference to the Protector and her percentage of merit, in the tables he has submitted, so far as speeds are concerned. The speeds which he quotes were never verified by official inquiry, and the data was given to the president of the board of inspection and survey upon the arrival of that body at Newport in January 1904. It may make the case somewhat plainer to quote directly from that letter, which reads as follows: (Page 690, document 75, H. R., 1905).

"The Lake Torpedo Boat Co.
"Newport, R. I., Jan. 11, 1904.

"SIR:—It is our desire to anticipate the examination of the Protector by the board of inspection and survey by a brief statement regarding certain of the present features of the boat. We believe we may thus facilitate the board's work and help to a better understanding of the craft's condition and probable performance.

"The speed and endurance of the Protector will fall considerably below our original estimate. This will be due to the present inefficient screws—fitted the day we left Bridgeport—which have been tried out progressively over the official mile course since our arrival here. The results of these trials are given in the following table which we will be glad to have verified by the board and incorporated accordingly in its report. It will be seen that the ratio of slip is out of all reason and that speeds are way below the proper resultants of the power of the engines under their various conditions. New screws have been designed, based upon the findings of these performances, and corrections have been made which promise us a speed of 10 knots under light cruising condition.

The installation of these new screws, which must await return to our home waters, where proper mechanical facilities may be secured, will involve the fitting of new shafts and a modification and rearrangement of our rudders, both vertical and horizontal. The change to the vertical rudder will be a material improvement to the navigational power of the boat by bringing that rudder directly in the sweep of the thrust from the propellers."

It will be noted, by reference to the foregoing table, that the boat really went slower as more power was applied to the screws. This was owing entirely to the inefficiency of the propeller and had nothing whatever to do with the working of the boat as a submarine pure and simple, and the problems directly associated therewith. I should like to call the attention of the members of this society to the very curious fact that with 30 H. P. more, the boat made 1½ knots less speed. The developed area of the propeller was 65 per cent of the disc area, and the number of blades was three. Not being a propeller expert, I am unable to explain the results, but it has since been suggested by other experts that the revolutions were so high, the pitch of the propeller so small, and the projected area in its relation to disc area so great that the water did not have a chance to get to the blades of the propeller at the increased number of revolutions which were secured by reducing the pitch. The inefficiency of the screws decreased more rapidly than the additional horsepower could counterbalance; consequently the ship went slower.

Under these circumstances, knowing that the Protector had already made much better speed, and bearing in mind that the vessel had been developed at great private expense, the owners felt justified in asking that the board try out the boat in all other respects, especially as the Fulton had not arrived, in fact, did not do so until five months later, and the deliberate examination of the Protector could otherwise in no way impose limitations, or inconvenience, to any one else. Her owners wanted the boat examined in all the other respects of a submarine craft, and asked consideration of these particulars in so far as they related to the reliability, the habitability, the safety, the ease of control and the general adaptability of the boat for war purposes. The Protector at that time had been in commission for nearly a year, and during that period had spent several months at Newport, making frequent runs in the presence of officers there on duty.

There are some peculiar things about these propellers which will interest the propeller experts of the society. I have here three sketches of the propellers used on the Protector. Propeller No. 1 was the first propeller used on the Protector, and the most efficient one. Propeller No. 2 is the one used which gave the poor results and which were used by Mr. Spear in his article. I will not mention the name of the firm which made this propeller, but from the tables submitted to the president of the board you will note that with 30 H. P. more going through the propeller, when the blades of same were set at 4 ft. pitch, and at 280 revolutions, the boat went nearly a knot and a half slower than she did with 5 ft. pitch turning only 240 revolutions. In other words, with 30 H. P. more, she went practically a knot and a half less.

As I have previously stated, these propellers were put on the day before we left Bridgeport and there was no opportunity for trying them out until we arrived on the official course at Newport. There was no time then to change back to the first design, as new hubs and shafts had been fitted to accommodate these so-called "improved" propellers.

On Jan. 12 the Protector started out to run her trials over the official measured mile course, but when arriving at the place of trial in Narragansett Bay, large floes of ice were encountered and, notwithstanding that her owners were willing and anxious to run the submerged trials the board decided to postpone the tests until the following spring, remarking that the Fulton might then be ready. The Fulton did not appear, however, until the Protector was put out of commission after being sold to go abroad.

It may be pertinent to state here that an army board examined the Protector a week later, under even more trying conditions, and the performance of the boat on that occasion was deemed sufficient warrant to recom-

AVERAGE RUNS OF PROTECTOR OVER GOVERNMENT COURSE OF 1 KNOT AT NEWPORT.

TRIAL NUMBER	AVERAGE TIME HRS. & MIN.	PITCH, FT. & IN.	REV. PER MIN.	SPEED REV.	ACTUAL SPEED, KNOTS	DEVELOPED HP.	SLIP, KNOTS	SLIP, PER CENT	REMARKS
1	9 50	4 0	280	11.2	6.1	224	5.1	45	Engines alone, water in after tanks and superstructure to get stern down.
2	8 00	5 0	240	12.0	7.5	192	4.5	37	Engines only, no water in tanks.
3	8 30	4 5	264	11.88	7.44	211	4.44	37	Engines and motors.
4	7 30	5 0	312	15.6	8.0	390	7.6	49	Engines alone not very steady owing to slow speed.
5	10 00	5 0	175	8.75	6.0	140	2.75	34	Motors alone, submerged.
6	15 30	2 5	...	.....	3.8	100	....	....	

In trial No. 4 the engines developed 249 hp. and the motors 141 hp., making a total of 390 hp. for both.

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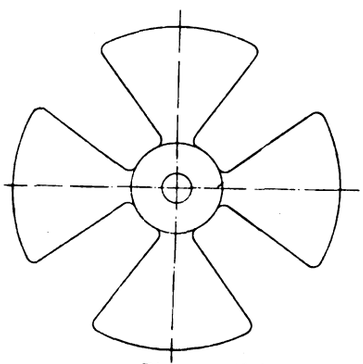
mend the immediate purchase of five of that type.

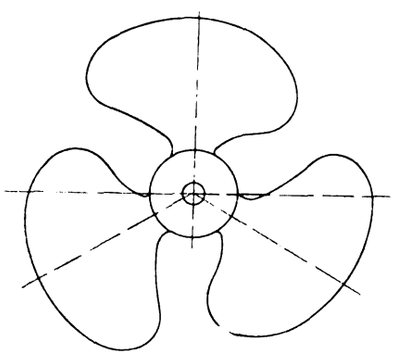
The record of No. 2 propeller tests was submitted purely with the frank intent of showing the peculiarities and inefficiency of the screws which expert judgment had prescribed. That record, however, has been circulated in many countries, and many people, not aware of the true conditions, have been led to believe that those figures were really the Protector's trial figures as actually determined by the United States naval board of inspection and survey. As a matter of fact, those figures were nothing like as good as the boat had previously made, nor as good as she did on her trials

NO. 1



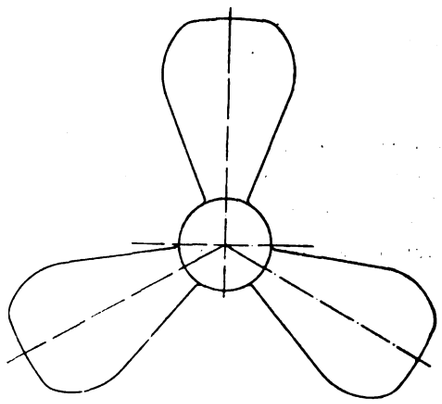
Diameter, 45 in.
Pitch, 3 ft. 0 in.
Developed Blade
Area, 56.3 per cent of Disc.

NO. 2



Diameter, 49 in.
Pitch, 4 ft. 0 in.
Developed Blade
Area, 65 per cent of Disc.

NO. 3



Diameter, 61 in.
Pitch, 3 ft. 6 in.
Developed Blade
Area, 33.5 per cent of Disc.

abroad preliminary to her acceptance by the Russian government. Upon the departure of the board in January, 1904, the Protector was docked and an opportunity taken to convert the improved screws into old junk.

The speaker then designed a screw of still greater diameter, but as I have already stated, I am not a propeller expert, and while these No. 3 screws gave better results than screws No. 2, their efficiency was not as great as that of the screws originally fitted to the boat. These No. 3 screws were the ones, however, used on the official trials, preliminary to the acceptance of the Protector by the Russian authorities. I beg the indulgence of this society while I read that report.

OFFICIAL RUSSIAN REPORT UPON TRIAL OF THE LAKE BOAT PROTECTOR, NOW THE OSETR OF THE RUSSIAN NAVY.

On the 25th, 26th, 27th, and 28th of September, 1904 (old style), the commission appointed by the general staff of the Imperial Russian marine on Sept. 11, 1904, under Order No. 16,094, directed the trials of the torpedo boat Osetr during the run from Kronstadt to Bjorko sound and in Biorko sound itself.

The commission, under the presidency of Commander M. Becklemicheff, was composed of the following members:

Commander Golovnine,
Lieutenant von Schulz, 4th,
Lieutenant Gadd,
with the assistance of the following representatives of the Naval Technical Committee:
Captain Zalessky,
Head Ship Builders' Asst., Mr. Gavliloff,
Head Machinist's Asst., Mr. Karpoff.

The run of Sept. 28 from Kronstadt to and over the measured mile, and from there to the place of the principal trials in Bjorko sound, was made quite successfully.

In the above run both gasoline engines were used alone working with benzine, except over the measured mile, when the engines worked in conjunction with the motors.

The average speed of the run was, at 248 revolutions, at the rate of 6.75 knots.

On the measured mile the inventor adjusted the propellers at the most advantageous pitch. The engines worked during the entire run without any trouble.

After arrival at Bjorko sound, alongside of the schoolship Oprychnik, a diver was sent out from the diving compartment of the Osetr to a depth of five fathoms and executed successfully the order given by the commission, consisting of picking up and handing into the compartment an electric lamp which had been lowered from the Oprychnik.

The following trials were made on Sept. 26:

The transition from the position on the surface (normal cruising condition) to the awash, or half submerged condition (war-time cruising condition) was made in eleven minutes, by filling the superstructure by means of pumps. In this condition the deck of the superstructure is on a level with the surface of the water.

After that the check valves of the ballast tanks were opened and tank No. 1 forward and tank No. 1 aft were filled with water. The time required for filling was between two and three minutes. The boat submerged to the top of the conning-tower. In this condition the sensibility of the boat to the longitudinal changing of weights was as follows:

20 puds (720 lbs.), moved for a distance of 20 ft., produced an inclination of 3½.

Then the boat was sent ahead, and the time required for the distance of 0.88 miles, in a completely submerged condition, at the forced speed of the motors, was 9½ minutes; that is, the speed was 5.6 knots.

From the last mentioned position, the speed of descent was determined. Six fathoms of the anchor's cables having been released, and the central ballast tank having been filled, the boat descended in 58 seconds to a depth of 62 ft.

On the same day a trial was made of firing wooden blocks (dummy torpedoes) from the forward torpedo tubes by means of air pressure, in war-cruising (awash) condition. The trial was quite successful. No change in the trim of the boat was observed. A firing pressure of 60 lbs. was used.

A trial of running on wheels was made. This without doubt is quite possible on a smooth bottom, and the passage of the wheels over small stones was successfully executed. The commission considers the wheels very useful to prevent injury to the hull of the boat.

On Sept. 27 the following runs were made on the measured distance of 0.88 miles, and the speeds were as follows:

(1) Normal cruising condition, engines only, 8½ knots, at 240 revolutions.

(2) Normal cruising condition, engines and motors combined, 9.3 knots, at 300 revolutions.

(3) War cruising condition (conning-tower awash), engines only, 7.4 knots, at 224 revolutions.

(4) Submerged, motors only, at the normal discharge rate, 5.4 knots, at a pitch of 2½ ft., 300 amperes and 115 volts. (The full speed submerged was slightly over six knots.)

The change from the engines to the motors was made in 15 seconds.

The time consumed in passing from the war-cruising (awash) condition of the boat under engines, conning-tower only above the water, to the totally submerged condition, with motors, was 1 minute 55 seconds.

In addition trials of trolling, or grappling for mines through the cock in the diving-door, while running along the bottom, were made. The difficulty of such work on a rocky bottom was shown, and success on a rocky and irregular bottom is very doubtful.

In view of the above results, the commission decided as follows:

The boat maneuvers easily, maintains well uniform depth, and is suitable for coast defense. The boat can be accepted by the government after the teaching of the crew.

In addition, the commission considers the following repairs and changes as necessary:

(1) To tighten the air compressor.

(2) To change the wood in the port side clutches.

(3) To supply the boat with a new omniscope. (Still later pattern.)

(4) To replace part of the wooden bulkhead on which the rheostat is fitted with non-combustible material—asbestos or slate.

(5) To present drawings of the boat, its motors and other details.

(Signed by the president and members of the commission and the representatives of the Naval Technical Committee assisting.)

From this report it will be seen that Mr. Spear's tables at least so far as they relate to the Protector, are unreliable. If Mr. Spear will submit the full report of the Russian trials of the Fulton and those of other competing types tried by the Russian naval authorities, perhaps better and more accurate deductions could be drawn as to the relative efficiency of the different boats tested by the imperial authorities.

In the speaker's judgment speed is not the first essential in a successful submarine boat. The United States navy department, in 1893, when asking inventors to submit designs for under-water craft, placed safety at the head of the requirements. The order of importance in which the various elements were officially given, was as follows:

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1. Safety.
2. Facility and certainty of action when submerged.
3. Speed when running on the surface.
4. Speed when submerged.
5. Endurance, both submerged and on the surface.
6. Offensive power.
7. Stability.
8. Visibility of object to be attacked.

Had the navies of the world followed this order of valuation of desired elements in the designs of their submarines, the lives of 60 odd persons need not have been sacrificed, as they have been during the past three years, by disasters to submarines.

In making any comparative table it is not possible to secure a true estimate of the relative merits without considering the elements above named; and should any change be made in that scale of values, no change of position could excusably alter the prime and vital importance of safety.

I am willing to concede that, perhaps, the cigar-shaped form of vessel is capable of greater speed when running submerged than is possible with other forms upon a fixed measure of displacement and power, but I contend, without fear of authoritative contradiction, that experience with the diving type of vessel, during the past 100 years, has shown that it is too unstable and unreliable to be safe.

According to numerous official reports both in this country and abroad, it has been shown that this cigar-shaped form of hull, common to the diving type, has a tendency to cause the boat to make sudden and unexpected head-first dives. In these reports it is shown that it is necessary for the crew to remain at their stations and that a very delicate adjustment of ballast, and men of long training and quick juggling skill, are required to navigate and to control these boats when running submerged.

I shall not take your time to read extracts from the numerous reports made upon this line. Sir William White, Prof. J. H. Biles, Rear Admiral Melville, Rear Admiral O'Neil, Capt. Edgar Lees, and Captain Bacon have amply testified in the various discussions and hearings upon the subject of the submarine, and the accidents that have happened to that class of vessel.

Mr. Spear has implied by his discussion of the question of stability that a boat with a water-tight superstructure has less stability than one without a superstructure; and for the purpose of making his point he has taken the Protector as a type and has assumed conditions which do not exist in modern boats of the "Lake" type, fitted with superstructures. He will, perhaps, be surprised to learn that in some of the "Lake" boats now under construction the center of buoyancy is as much as 22 in. above the center of gravity when in a submerged condition.

I doubt if any of the diving boats in existence have half of this. Even the Protector, referred to by Mr. Spear, must have had greater stability than the Fulton, according to the official reports of the operations of these rival boats.

There is an old saying that "the proof of the pudding is in the eating." In the official trials of the Protector, in Russian waters, there were 19 persons on board, including the officers of the commission and a Russian trial crew undergoing instructions and her own crew. These men were permitted to move freely about in the boat.

In the later boats several men have moved at one time from the extreme forward end of the boat to the extreme after end of the vessel—while running submerged—without changing the depth of submergence more than a few inches.

In discussing stability, Mr. Spear says:

"By fitting watertight superstructures the actual center of buoyancy may be raised but the metacentric height, far from being increased, is actually decreased. This arises from the fact that such superstructures cannot be constructed sufficiently strong to withstand high pressures, hence must be filled with water when submerged. It follows inevitably that the center of gravity is raised as much as the center of buoyancy, leaving the stability intact, but the large weight represented by the large superstructure raises the center of gravity of the hull as a whole and so diminishes the metacentric height."

The first mistake is in the assumption that by admitting water into the superstructure the center of gravity is raised. He has lost sight of the fact that, when submerging, water is also admitted into the lower ballast tanks, and that if more water is admitted into the lower tanks below the normal center of buoyancy than is admitted in the superstructure above the center of buoyancy, the center of gravity in a submerged condition may also be lowered.

The next wrong assumption is that the air and fuel tanks used for storage purposes "generally weigh more than the water they displace and so serve to further decrease the metacentric height."

As a matter of fact, the fuel tanks, as used in the "Lake" boats, even when filled with gasoline, weigh less than the water they displace, and consequently add a buoyant moment well above the center of gravity of the boat when she is in a submerged condition.

In the latest type of the "Lake" boats the cigar-shaped form of hull has been abandoned, thereby raising the center of buoyancy of the main hull six inches above the center of buoyancy of a corresponding hull of cigar-shaped form. The superstructure itself, even when filled with water, adds a large buoyant moment several feet above the center of gravity. This is owing to the buoyant character of its construction. As a result it is possible to secure a form giving a difference of 22 in. between the center of buoyancy and the center of gravity, when the boat is in a submerged condition. I do not believe that it is possible to distribute the machinery in a hull of cigar-shaped form so as to get a difference at best of more than 10 in. between the center of buoyancy and the center of gravity of such a vessel submerged.

I would like to call the attention of the members to the sketches which I have made on the blackboard showing the difference between the stability capable of being attained with the cigar-shaped form of hull, as used in the diving type boats and the form of hull used in the submersible type, herein referred to, with buoyant superstructure and hull of different form.

There is sufficient testimony to the point that the diving submarine must be run at a considerable speed in order to get her under water, unless her reserve of buoyancy is very small and her longitudinal stability slight. The greater the stability of the diving boat, the higher must be her speed in order to enable the vessel to make her initial plunge. Model experimental tank trials and the fatal records of the past three years have shown that there are certain forces exerted at the bow of a spindle-form diving boat which exert a down pull at higher speeds and tend to make the boat plunge when least expected.

The British may be said, I think without fear of contradiction, to have brought the diving type to its highest state of perfection. But notwithstanding this, the numerous fatal disasters and narrow escapes from serious mishaps among their submarines, have caused them—as I was recently informed by a British officer in an authoritative position—to abandon the exclusive use of the stern rudder and, to quote this officer, "to adopt the hydroplane as their means of sugmergence."

According to a recent article by Sir William White (see page 948 of the

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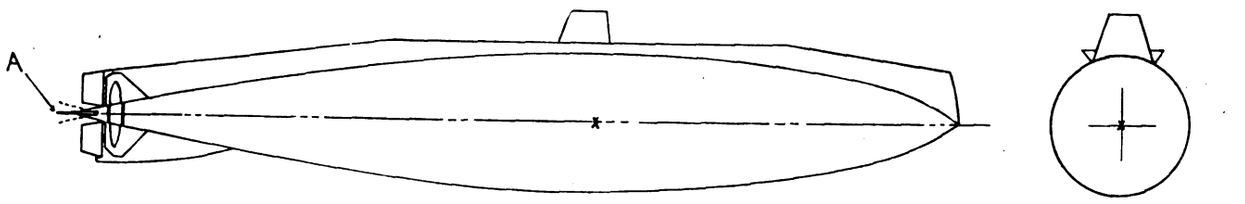
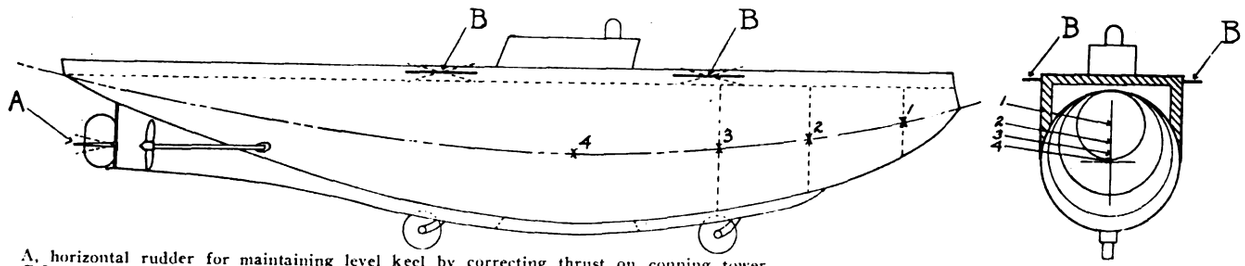
Journal of the American Society of Naval Engineers, August, 1906), they have also adopted the water-tight superstructure. This water-tight superstructure, as applied to the "Lake" boats, gives greater seaworthiness and affords greater stability, both in the surface and in the submerged condition. It will, therefore, be seen that all the important navies of the world have finally adopted in their submarines at least two of the novel features at first described and shown in the plans of the even-keel "Lake" type, as submitted to the United States navy department in 1893.



X, center of buoyancy of each section of a cigar-shaped craft is on the axis, which is a straight line.
A, horizontal rudder, to cause boat to change from level keel and to make her either dive or return to the surface.



A, horizontal rudder for maintaining level keel by correcting thrust on conning tower.
B-B, hydroplanes for submerging.
Center of buoyancy is raised at both bow and stern, as shown at sections 1, 2, 3, and 4 in this form of hull. The superstructure is built of buoyant material and consequently it is possible to get much greater stability. The change of form of hull gives a rise of center of buoyancy of 6 inches in certain Lake boats now under construction, while the buoyant superstructure gives still more.

In May, 1902, before the committee on naval affairs in the house of representatives, Mr. Spear, while discussing the "Lake" boat, had this to say in reference to the Protector, then building:

"Now, he has what he calls 'hydroplanes,' an auxiliary method for coming up. Hydroplanes are nothing but vanes, steel planes hung in the middle of the ship the inclination of which you can change if you like. They are designed to lift the vessel or to lower her bodily in the water. Let us assume that he has to go up from the bottom with his hydroplanes. I started out on the assumption that everything that Captain Lake hoped to do is to be carried out. As an expert I do not think that he will make his hydroplanes work because they have been tried for twenty or thirty years and have been discarded. It is an old idea and will not work."

The operation of the hydroplanes is then described by Mr. Spear, and he further states:

"It has never been worked successfully yet. Captain Lake has not worked his boat successfully and will never work a boat that way. It is what he hopes to do with his new boat but it has never been worked and it has been tried time out of mind by all the experts. The Argonaut has not developed those things. Nordenfeldt worked on it for years. Mr. Nordenfeldt's boat was not of the Holland type; that was the trouble. It was an even-keel boat, like Mr. Lake's. This dictum about the necessity of keeping the keel parallel and horizontal was laid down by Mr. Nordenfeldt and has never been based on any sound reasoning or any sound theory or common sense or experience."

Since that statement was made, every nation building submarines abroad, so far as the speaker's knowledge goes, has finally adopted the hydroplane. It might have been wise had Mr. Spear been more cautious in his pre-judgment of the Protector and the success of the hydroplane, as the hydroplanes of the Protector were never modified or changed in any way, and they worked with precision and complete success from the date of the boat's initial submergence.

Mr. Spear does not give a description of the new boats now under construction, but a public photograph of one of them shows something attached to the superstructure which looks suspiciously like hydroplanes. It therefore looks as if the author of the paper on "The Development of the Submarine," like the submarine designers abroad, has finally recognized the importance of at least one of the features which, in 1902, he wished to be placed on record as stating they "will not work."

For the sake of the brave fellows who go down in the sea in submarine boats, let us hope that safety and reliability of action in the semi-submerged and submerged condition will be the paramount factors in controlling future designs of submarine craft.

Mr. Lawrence Y. Spear.—If the discussion is to be closed by me, I think you will have to extend the meeting for four or five more days. Capt. Hovgaard and Mr. Lake have presented so many features that we might pay some attention to, that it is utterly impossible for me to undertake it. It would require a much longer paper than my original paper for me to discuss the matter at all, and I think that half statements on this subject are a great mistake. If it is to be discussed at all, it should be discussed thoroughly rather than discussed in a cursory way. Mr. Forbes' question principally related to the matter of safety; Mr. Lake also anticipated the importance of that feature; so I think, does everybody else who has anything to do with boats. If Mr. Forbes wishes any information on that subject, I will refer to Capt. Bacon's article before the British Society of Naval Architects either last year or the year before. He was in charge of the submarine of the English Navy and now commands the battleship Dreadnaught, and his record as a practical expert submarine officer is of the highest order. He gives a clear exposition of the causes which led to the disasters which have occurred and states clearly as to what his opinion is in regard to the dangers in submarine vessels or any other vessel, with this conclusion, that the fear with regard to the matter is expressed by those who do not understand the subject. Those actively engaged in operating the boats have no fears about them. We all realize, as the boats imply a development is going on, there must from time to time, no matter what the type of boat, be accidents which are inevitable. I do not have to strain my memory very much to remember accidents in battleship turrets, and fire rooms of

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gunboats, and firerooms of ordinary torpedo boats. We all hear of accidents every day on railroads. There is no doubt, as the number of these boats increase that there must be occasionally an accident, but the point he makes, and his greatest point, is there is nothing inherent in the submarine boat making it any more dangerous than any other type of boat.

To refer to Capt. Hovgaard, he wants to know why we do not use heavy engine oil instead of gasoline. The difficulties in connection with the proper combustion of heavy oil simply knocks out the use of any engine suitable for this work, but I believe I am within the truth in saying that the problem is almost solved. It is being worked upon here and in England, in France, in Germany, and in Russia—in fact, it is being worked upon everywhere—and in the last few years very promising results have been achieved.

I personally have thought that within a year or so that change could be made, but up to the present time there has been no reliable heavy oil engine of this size and power and speed which is suitable for this work, not a single one. The main difficulty is that kerosene and the heavy oils generally are more difficult to vaporize than gasoline, and to get the proper combustion the oil must be held in strictly definite limits of viscocity, otherwise it forms carbon, and this carbon forms on the valve seats of the engine, and though many kerosene engines run successfully fon 24 or 48 hours, it is a different story after they have been running four months. I do not mean to say there is no such thing as a successful kerosene engine for small power, but I have spent many hours in investigating it, and have not found any yet. There is no doubt that a change will be made. I think, however, that the question of gasoline is a subject the dangers of which are apt to be overestimated. Gasoline itself is not at all explosive. Gasoline as carried in any type of submarine boat is in a closed receptacle absolutely, and in most types with which I am familiar, if they introduced a spark into the gasoline tank to make an explosion, there must be a mixture of air and gasoline vapor in certain proportions and the mixture varies from somewhere between 8 and 20 parts, in order to create an explosion, and above and below that it is not supposed that explosions will occur. The only danger is a leak of gasoline into the engine room and the vapors of the gasoline are what explode. The way that matter can be handled is to make the gasoline tanks of such design that it is impossible for them to leak. The total air on a submarine boat is generated every three or four minutes automatically, and that tends to give good ventilation and tends to prevent the formation of gasoline so that if a small leak should occur, with the very effective circulation of air on the boat there is no likelihood that an explosion would occur. There is no insurmountable difficulty in constructing the system so that there shall be no leaks. Of course, it requires care. Carelessness, either in construction or incompetence in handling, will result in trouble.

I doubt very much whether I can add anything of interest to Mr. Lake's interesting exposition of the type of boat for which he is responsible as the inventor. I think it is apparent to this society that we probably have a difference of opinion on this subject, and I doubt very much whether we would agree. It seemed to me, however, while he was delivering his remarks, that one might be led, possibly, to believe from what he said that I had been guilty, perhaps, of a little sharp practice in connection with the details of the Protector. Now, I think the paper states very distinctly what my authority was. I think the paper states absolutely that the speeds were taken from the Lake Co.'s own report to the navy department. That is perfectly clear. That is all the information I have had, or could have gotten hold of, on the speed over the measured mile of the Protector. I learned today for the first time from Mr. Lake of the much superior results of the first propeller and I am wondering why he did not put the first propeller back on the boat instead of using No. 3 propeller. I said in the paper that the official reports applied to all speeds, not only of the Protector, but her sister ship. I think that is correct. I have no doubt that he did, in getting some high speeds, get a more satisfactory propeller. I noticed, however, that the difference in the speed between what he did over there, and what he did here, is just about the same difference between what the Fulton did here and there. My natural conclusion was that the ways of running trials in Russia were a little more liberal. I have already answered that. Undoubtedly, if there were trial records available, which were reliable, showing higher speeds than I have described in my paper, the speeds of the Protector on the tables might be changed. I have not worked it out. Mr. Lake suggested that I take the official tables so far as I have them, of his boat and the other boat in Russia and see where they come. I will take pleasure in doing that. Nothing is further from my personal desire than to misrepresent what has been accomplished. I merely thought it desirable to lay before the society a few cold facts, not theories, but facts, and I have been very careful to avoid theorizing. Theorizing is dangerous, and Mr. Lake pointed out a while ago and quoted me in a statement I made when I was younger, and perhaps more enthusiastic than I am now, and I think the joke is on me. I never had an opportunity to approve that testimony. As it got into the printed record, it is not exactly what I said; nevertheless, in substance I must have said something like that. Therefore, I have endeavored to avoid all questions of inference, things we do not know anything about, and I have limited this statement to facts that can be measured. If we are to abandon that method of dealing with these subjects, we immediately get into the realm of conjecture. It is purely a matter of opinion as to whether one type of boat is safer than another, purely a matter of opinion, and you hardly ever get people interested in the different types of boats to agree on the subject, and you never come to any concensus of opinion. The principal thing today is to be satisfied that what you have has sufficient of these qualities, and then aim for a development to a higher degree of these qualities. It is possible to build a submarine boat which is practically fool-proof; every particular sort of an accident that possibly might happen has some possible remedy, either in original design or special device, but by the time the vessel is given up to that sort of thing entirely, you destroy its naval usefulness, such as speed, ease of action, celerity of motion, etc.

With regard to the question of stability, I do not know about the 22-in. boat of which Mr. Lake speaks, and he rather, of course, admitted that it was impossible for me to know anything about it. I gave you the facts as far as I could tell them, information regarding the Protector, published with the consent, presumably, of Mr. Lake. I took the figures of the other boat from an official determination. These are the facts in those cases. We were not entering into any discussion as to what is the most suitable submarine boat. I pointed out that fact because there has been frequently expression of opinion that it is neces-

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sary to have a small hydroplane, and that the principal object in cutting down bodily that hydroplane was that you get a submarine more stable than you could otherwise get it. I thought it would be interesting to give the facts, that the only two boats which had employed that system did not bear out that statement.

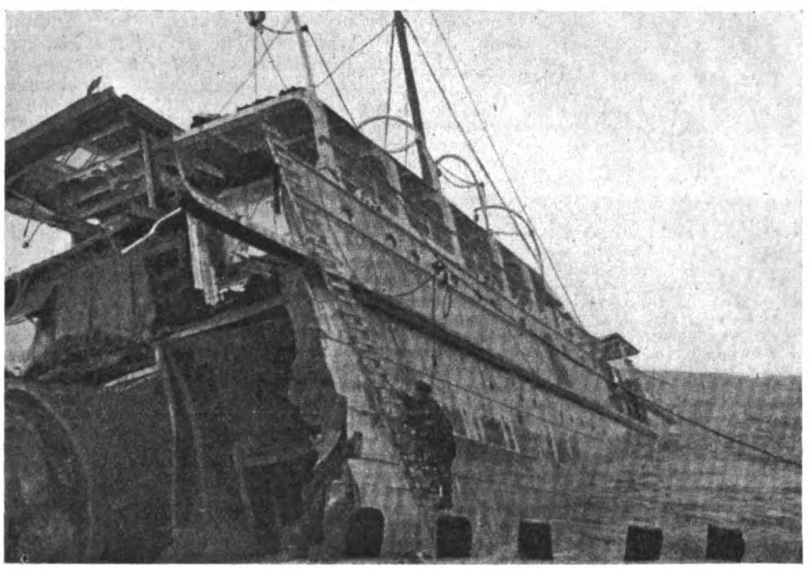
The President—We would like very much, I know, and I believe I voice the sentiment of all the members, if you could continue this discussion very fully, but the chair feels it incumbent upon him to suggest, Mr. Spear, that you could answer in extenso later, in a written discussion, and I will ask you if you will kindly make your remarks rather short at this time.

Mr. Spear—There are a number of other points here concerning which I think Mr. Lake perhaps, has some information, and if I can remember all of them, I shall take pleasure in presenting such parts as I know and give such other data as I can find, and I shall adopt the suggestion of the president and defer the rest of this talk until I can have an opportunity to go over the matter and touch on some particular points which require a little more elucidation.

SHIPWRECK OF THE BERLIN AT HOOK OF HOLLAND.

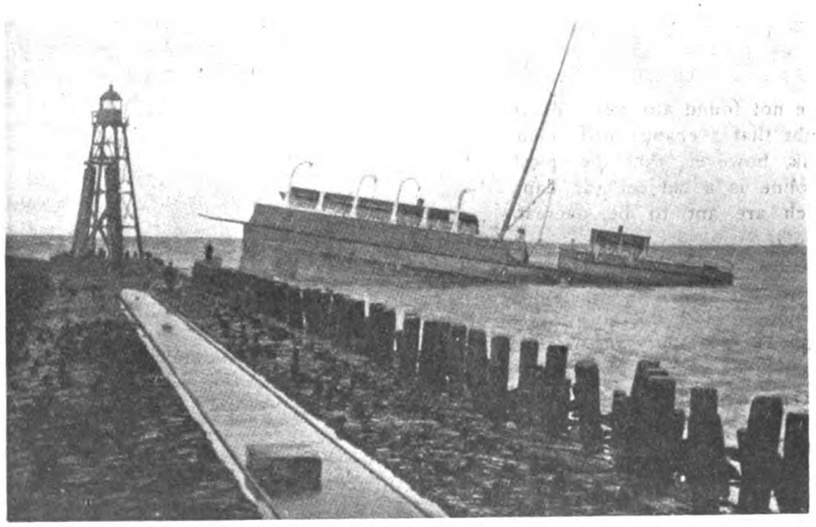
On the night of Feb. 20, the staunch steamer Berlin, owned by the Great Eastern Railway Co. of England, was shipwrecked on the northerly pier of the entrance to the port of the Hook of Holland. The French Journal, *L'Illustration*, immediately sent one of their staff artists with instructions to secure all views, sketches and interviews possible, so as to picture the exact facts concerning the disaster. This, by the aid of a very intelligent young Frenchman, who was a passenger on the ship, was done in an extraordinarily satisfactory manner. The account, in part, is as follows:

The steamer Berlin of the Rapid Service between Harwich and the Hook of Holland, was a nearly new steamer, 92 metres in length, and constructed on the type of the best trans-Atlantic liners, fine lines, and two smokestacks, carrying also two masts. The outfit was very comfortable, even luxurious, and the line was a very popular one between England and the continent.



SHOWING THE BERLIN BROKEN IN TWO ON THE PIERS.

The night of February 20-21 was very stormy, but the voyage was made in the usual time, and early in the morning the steamer, for some unexplained cause, missed the harbor. (It is thought that the steering gear gave out just at the wrong moment.) This was at 4.55 in the morning. The Berlin had been thrown by the tempest on the slope at the end of the pier and just outside of the lighthouse where it rested in equilibrium like the beam of a balance. The lighthouse, although but a few feet away, was scarcely visible through the blinding snow. Not a single boat could live in such a sea. All which were launched were broken immediately. Waves swept the hurricane deck and carried away some men. One of the latter, Capt. Parkeson, of Belfast, who was a passenger on the Berlin, was the only one rescued at this time from the sea. The other passengers grasped whatever they could hold and waited for daylight and succor. Every little while one of these unfortunates was washed away by the terrible seas. Soon, however, the situation became worse. Little by little the ship commenced to break in the middle at the foot of the funnels. The fore part of the ship commenced to sink with terrible breaking noises, and the weight of the engines soon caused it to disappear with all who were on board of it. In the after part of the ship, which was still above the waves, fifty people remained. Many were still washed away, others, especially children, succumbed to the cold. The



THE BERLIN ON THE PIER.

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remainder, trying to find a shelter against the terrible waves and the lashings of the snow, gathered as near as possible under two water tanks which were attached to the hurricane deck and close by the place where the ship was broken in two. They thus found themselves 30 yards or so from the lighthouse, but separated by a terrible gulf of raging waters. Besides this, the lighthouse itself and all the 1,800 yards of the pier swept without cessation by monstrous waves were absolutely inaccessible either from the side of the ship-

BRINGING IN THE DEAD FROM THE BERLIN.

wrecked people or from the land. About 11 o'clock an attempt was made by a life boat to approach them and to snatch them from their terrible tortures. The weather was still frightful. A glacial cold tormented them. The sea was making rather than subsiding. All day long repeated efforts were made by the sailors in the life boat to approach the wreck, but in vain. At night the poor wretches had to see this boat leave them without having saved a single person. Great steamers passing the port towards Rotterdam, were seen during the day only a few cable lengths away, but these also were unable to bring them the least help. Night fell. Some who had been standing all day for lack of a place to sit down, asked their companions to do them the favor of letting them sit a moment to rest. This was granted, "You may, there are three dead people." They took the place of those who had thus disappeared and by means of a piece of sail cloth stretched over them, they got what comfort they could during the long night. Friday came at last, and attempts at saving were recommenced, witnessed by thousands of anxious spectators from the land. Prince Henry, the queen's consort, had come to the Hook of Holland immediately upon learning of this disaster and went out on a tug in the midst of the brave people who a hundred times risked their lives to save their fellow beings. The day passed again in fruitless attempts. It was only at 4 o'clock in the morning, thirty-five hours after the shipwreck, that a line which hung from the wreck and floated near the pier could be seized. It was attached to the foot of the lighthouse. At length they were saved. Through this means the shipwrecked people could climb to the pier by holding on with all their limbs, suspended by the inclined cable. Six or seven sailors, up to their necks in the sea, clasping hands at the end of the pier, received the unfortunates who were half dead and scarcely covered by formless rags, so beaten about had they been by the tempest. They helped them over the staircase of the lighthouse and there successively along the pier, submerged by each wave, they dragged them, holding them up to the platform where a range light was put up. They then were transported, suspended by a rope, to a yawl boat between the piers where some sailors took them, and they were thus conducted to the life boat and from this to the tug where Prince Henry was located with the doctors, and where first aid was given to them.

Eleven people, men and women, several of whom belonged to a German opera company coming home from London, were thus saved the evening of February 22. It was thought at this time that there was no one left alive on the ship. On Saturday morning, however, the sea having gone down somewhat, the life savers could gain the wreck. There they found still three women. Thus the whole number of survivors was brought up to fifteen, counting the happy mariner, Capt. Parkeson.

BOOK REVIEWS.

The Sailors' Magazine and Seamen's Friend has issued its bound volume of last year's issues of its monthly magazine in convenient and attractive form, price $1.50.

"The Analysis and Softening of Boiler Feed Water," by Edmund Wehrenfennig, M. E., of the Austrian Northwestern railway in Vienna, in collaboration with Fritz Wehrenfennig, analytical chemist, director of factories in Eggenberg; translated by D. W. Patterson, M. E. New York. John Wiley & Sons.

With the aid of this work the subject of purification and analysis has been made plain to even such as are not chemists. The application of formulas, the introduction of systems and the improvement of existing types of softeners together with the experiences of German railroads in water softening should prove of value to Americans interested in this line of work.

"Marine Boilers, their Construction and Working, Dealing More Especially with Tubulous Boilers." Second edition, revised and enlarged. New York. D. Van Nostrand & Co. Price $5.00.

This work is an exhaustive study of the subject based on the work of L. E. Bertin, late chief constructor of the French navy, translated and edited by Leslie S. Robertson, M. Inst. C. E., M. Inst. M. E. and M. Inst. Naval Architecture.

The edition has been brought up-to-date, the most notable addition being the chapter on "Liquid Fuel" by Engineer-Lieutenant H. C. Anstey, R. N., giving the latest British practice and developments.

The volume is profusely illustrated and in its English dress much information has been added of the latest French practice, thus giving to American engineers an opportunity to know the progress of their British and French colleagues.

"Mast and Sail in Europe and Asia," by H. Warington Smyth. Illustrated. New York. E. P. Dutton & Co.

A truly delightful volume to the lover of sailing craft, may be said of this work. Being literary rather than technical the work smacks of the sea —of long days and nights of cruising in far-off waters, the study of people from the standpoint of their sailing abilities—and all this is aside from the pleasure craft, dealing entirely with craft in which the myriad seafaring tribes of earth perform the measure of their tasks from day to day. The volume is typographically attractive and is profusely illustrated.

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